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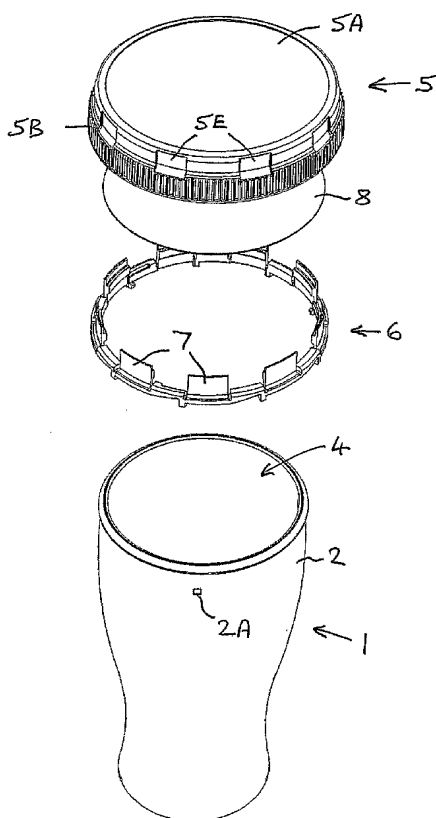
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(54) Title: PACKAGING ARTICLE



(57) Abstract: A container comprising a container body (1) having a circular opening (4) which defines an axis, a cap (5) to close the opening (4) and a collar (6), the cap (5) comprising an annular skirt (5B) having a plurality of spaced apart projections (5F) around its inner circumference and the collar (6) comprising a ring with a plurality of spaced part flaps (7), (or other radially moveable parts) provided thereon, the collar (6) being arranged to fit between the container body (1) and cap (5) with their axes aligned such that the projections (5F) engage axially facing surfaces (6A) of the ring and the flaps (7) (or other radially moveable parts) engage an axially facing surface (3B) of a lip (or other features) (3) of the container body (1) whereby the cap (5) can be secured to the container body (1).



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The present invention relates to containers, and particularly relates to containers for supplying beverages to consumers. The invention has particular utility for the storage and supply of carbonated and other sparkling drinks, but is also suitable for use with other types of drinks or other materials. The invention also relates to container bodies, a cap and the combination of a cap and collar for providing such containers.

Background Art

Containers that have a separate ring or collar carrying a screw thread for securing a cap to the container, are known from United States Patent Nos. 3,603,472 and 4,576,296, International Patent Application WO 84/01763, and European Patent Application EP 0517676, for example. The applicants have also proposed containers with cap-on-collar closures as described, for example, in WO 2006/000774 the disclosure of which is incorporated herein.

Summary of Invention

The present invention seeks to provide improvements over containers such as those disclosed in WO 2006/000774.

According to a first aspect of the invention, there is provided a container comprising a container body including a circular opening which defines an axis, a cap to close the opening and a collar, the cap comprising an annular skirt portion having a plurality of spaced apart projections around its inner circumference and the collar comprising a ring with a plurality of spaced apart flaps, or other radially moveable parts, provided thereon, the collar being arranged to fit between the container body and cap with their axes aligned such that said projections respectively engage axially facing surfaces of the ring and the flaps or other radially moveable parts engage an axially facing surface of a lip (or

other features) of the container body whereby the cap can be secured to the container body.

According to a second aspect of the invention, there is provided a container comprising a container body including an opening, a cap to close the opening and a collar arranged to fit between the container body and the cap, the collar having a plurality of spaced apart flaps or other radially moveable parts provided thereon and the cap having a first set of cam surfaces for urging the flaps or other radially moveable parts radially inwards to engage the container body and a second set of cam surfaces for urging the flaps or other radially moveable parts radially outwards to disengage from the container body upon rotation of the cap relative to the collar.

Preferably, the cams of the first and second sets of cam surfaces are arranged alternately around an inner surface of the cap and rotation of the cap relative to the collar moves the flaps or other radially moveable parts from engagement with the first set of cam surfaces into engagement with the second set of cam surfaces. Each flap or other radially moveable parts thus follows a chicane pathway during this rotation.

According to a third aspect of the invention, there is provided a container comprising a container body including an opening, a cap to close the opening and a collar, the collar being arranged to fit between the container body and the cap so as to secure the cap to the container body, the collar having one or more inwardly directed projections for engaging one or more features of an external surface of the container body whereby rotation of the collar relative to the container body is limited, said one or more projections being provided on a resilient arm extending from said collar so as to be radially moveable into and out of engagement with said one or more features of the external surface of the container body. Preferably, said one or more projections are provided at the distal ends of resilient arms which extend part way around the inner

circumference of the collar or which extend in a substantially axial direction from the collar.

According to a fourth aspect of the invention there is provided a container comprising a container body including an opening, a cap to close the opening and a collar arranged to fit between the container body and the cap, the cap being rotatable relative to the collar between a first position in which the cap is secured to the container body via the collar and a second position in which the cap is removable from the container body, the cap being secured to the collar by a threaded engagement therebetween, said threaded engagement being arranged to provide a vent for venting gas from the container body, at least when the cap is in an intermediate position (between fully secured and fully released).

According to another aspect of the invention, there is provided a container comprising a container body including an opening, a cap to close the opening and a collar arranged to fit between the container body and the cap, the cap being rotatable relative to the collar between a first position in which the cap is secured to the container body via the collar and a second position in which the cap is removable from the container body, the cap having skirt portion with a plurality of spaced apart apertures therein through which parts of the collar are visible so as to provide a visual indication as to whether the cap is in the first or second position relative to the collar.

According to a further aspect of the invention, there is provided a container body for use in providing a container as described above, the container body having a smooth lip extending around the opening thereof and one or more isolated retaining features in an external surface thereof. The retaining features may be isolated recesses in an external wall of the container (spaced from a lip of the container), or a recess in the container lip or a stop feature provided on the underside of the container lip. Preferably, the external surface of the container body towards the open

end thereof is substantially parallel-sided or flares outwards such that the container body can be manufactured by an injection moulding process. Preferably, the container body is shaped so as to be nestable within another container body of the same shape.

According to a further aspect of the invention, there is provided a cap and a collar for use in providing a container as described above. The collar may be pre-assembled within the cap. The cap and collar may be arranged so as to be manufactured as a single component and then separated either before or after the collar has been assembled within the cap. The cap and collar may be joined by interconnecting parts which are ruptured as the cap is rotated relative to the collar.

According to yet a further aspect of the invention, there is provided a cap for use in providing a container as described above. Preferably, the cap has a skirt portion with a plurality of spaced apart apertures therein and a plurality of spaced apart projections around its inner circumference, respective apertures and projections being aligned with each other whereby the apertures facilitate manufacture of the cap by an injection moulding process using a straight up and away injection moulding tool.

Further optional and preferred features of the invention will be apparent from the following description, from the drawings and from the subsidiary claims of the specification. It should be noted that the preferred and optional features of the subsidiary claims may be used with any of the aspects of the invention referred to above and in a wide variety of combinations in addition to those specified in the subsidiary claims.

The present invention also extends to other novel combinations of features described herein and is not limited to the inventions referred to above.

An advantage of the invention is that by providing a collar on a container body, to which a cap may be secured in order to close the container, which collar preferably may be removed from the container body, enables the container body to be free from exterior threads or other securement means for securing the cap thereto. Providing a beverage container that is free from exterior threads or other securement means enables the provision of a truly practical beverage container from which consumers may drink directly. This is because the presence of threads adjacent to the opening is a major reason for bottles and known wide-mouth containers being impractical as truly acceptable drinking vessels for consumers.

For the avoidance of doubt, it is to be understood that the term "collar" as used in this specification does not include known cap-like parts that extend across openings in containers.

Other advantages that the present invention can (at least in some embodiments) provide, include the following:

- De-coupling the method of securing the cap to the container body (i.e. via the collar) from any method of sealing the container (e.g. via a seal provided between the cap and the container body). This is to be contrasted from known containers in which an inner cap-like part both provides a seal against the container body and contributes to the securing of an outer cap to the container body, for example. Such de-coupling can often provide both better sealing and better securement.
- The placing of the means of securing the cap to the container body (i.e. the collar, or parts (e.g. flaps) of the collar) under compression (between part of the cap and part of the container body) rather than under tension. This is to be contrasted from known containers in which an inner cap-like part contributes to the securing of an outer cap to the container body, via parts of the inner cap-like part that are placed under

tension. The placing of securing parts under compression rather than under tension can often provide stronger securement.

Preferably, the container body of the invention includes one or more retaining parts by which the collar is retained on the container body until removal of the cap causes the collar to be removed or removable from the container body. Advantageously, the retaining part may be a rim or lip of the container body, preferably a radially-outwardly projecting lip. Preferably, the collar is retained on the container body by being trapped beneath the lip or other retaining part of the container body. Additionally or alternatively, the (or each) retaining part could be a recess (e.g. a depression or indentation) in a surface, preferably an exterior surface, of the container body. For example, the container body may be provided with one or more recesses provided around the exterior circumference of the container body.

In preferred embodiments of the invention, the collar can engage with and/or can be secured to the container body independently of the cap. That is, preferably the collar does not require the action or the presence of the cap in order for the collar to be engaged with and/or secured to the container body.

Preferably, the collar comprises a plurality of flaps or other radially moveable parts arranged spaced-apart from each other along the circumferential extent thereof, the cap and the collar including cooperating securement means by which the cap may be secured to the collar.

Preferably the flaps or other parts of the collar are indirectly connected to each other by means of a ring portion of the collar to which the flaps or other parts are directly connected. When the collar is attached to the container body with the container body upright and the opening uppermost, preferably the ring portion of the collar is the

lowermost portion thereof, with the flaps or other parts extending substantially vertically therefrom. The flaps or other radially moveable parts of the collar preferably include radially-inwardly projecting shoulders which preferably engage with an axially facing surface of the lip or other retaining part of the container body to retain the collar thereon.

The cap is releasably securable to the container body via the collar, preferably by means of a threaded engagement with the collar. Consequently, the (or each) securement means of the collar and/or the cap preferably is a thread. The threaded engagement may comprise a screw-threaded engagement. Preferably, however, the threaded engagement is a bayonet-style engagement. The term "thread" as used herein includes (at least in the broadest aspects of the invention) continuous and discontinuous threads, (e.g. continuous and discontinuous screw threads), and bayonet-style threads, for example. Threads used in relation to the invention may, for example, comprise a plurality of segments (each thread segment comprising a said securement means), in which case the thread may be discontinuous (e.g. a discontinuous screw-thread or a bayonet-thread), or it may be substantially continuous because the effect is that of a substantially continuous screw-thread pattern.

The use of thread features comprising a plurality of circumferentially spaced apart components reduces the torque required to release the cap. This is of particular importance with a wide mouth container otherwise the torque required to unscrew the closure may be difficult for user to apply by hand.

The opening of the container body is preferably a wide-mouth opening. By a "wide-mouth opening" is meant (at least in its broadest sense) an opening of a size suitable for a person to drink from the container in the same manner as from a drinks glass or similar drinking vessel. That is, in its broadest sense, the wide-mouth opening of the

container (for embodiments of the invention having a wide-mouth opening) generally renders the container suitable as a drinking vessel from which a beverage supplied in the container may be conveniently drunk (in contrast to conventional narrow-necked bottles and ring-pull cans which generally are not regarded as comfortable drinking vessels). In practice, this requirement means that the diameter of the wide-mouth opening of the container will normally need to be at least 40mm, preferably at least 45mm, and more preferably at least 50mm. Additionally, an excessively wide opening is generally difficult for the consumer to drink from, and thus the wide-mouth opening preferably has a diameter no greater than 150mm, more preferably no greater than 100mm, and especially no greater than 80mm. A particularly preferred diameter range for the wide-mouth opening is 50 to 80mm, and examples of particular preferred diameters include 53mm and 63mm.

Alternatively, the opening of the container body may be a narrow-mouth opening, e.g. a bottle-type opening. Such an opening may have a diameter of less than 40mm, for example. Conventional standard bottle mouth sizes include diameters of 28mm and 38mm, and the opening of the container body of some embodiments of the present invention may have such a diameter.

The container body preferably has no thread or thread segments on its exterior. Consequently, the container body preferably is comfortable for a consumer to drink directly from the container body.

A wide variety of thread forms for securing the cap to the container body via the collar, is possible. As indicated at the beginning of this specification, at least some embodiments of the invention are intended for the storage and supply of carbonated and other sparkling drinks, for example beers, ciders, sparkling wines (including champagne), other fizzy alcoholic beverages, and non-alcoholic fizzy and sparkling beverages, including sparkling water and carbonated soft drinks. For such beverages,

it is preferred for the engagement between the cap and the collar to include provision for gas venting upon partial removal of the cap from the container body, to prevent so-called "missiling" of the cap whereby the cap is violently ejected from the container body as the container is opened, by the gas pressure of the contents of the container.

Advantageously, therefore, the collar and the cap may include means, preferably engageable elements, to block or restrict removal of the cap from the collar beyond an intermediate position (between fully secured and fully released) when the cap is under an axial pressure in a direction emerging from the container body.

Preferably the cap, the collar and the container body are constructed and arranged to provide a vent for venting gas from the container body at least when the cap is in an intermediate position (between fully secured and fully released).

In some embodiments of the invention, the removal of the cap from the container body may cause the removal of the collar from the container body. Additionally or alternatively, the act of removal of the cap from the container body may cause the collar to be removed from the container body together with the cap. That is, the collar may be removed from the container body together with the cap, for example as described above.

In some embodiments of the invention, the cap and/or the collar may include tamper-evident means (e.g. a tamper-evident band). Preferably the tamper-evident means is ruptured or removed from the cap or the collar (respectively) by the act of removal of the cap from the container body. Advantageously, the tamper-evident means and/or the collar may include means to prevent the cap from accidentally unscrewing from the collar under the influence of pressurization within the container (e.g. due to a pressurized beverage held in the container).

Embodiments of the invention preferably include sealing means to seal the container. Such sealing means may comprise part of the cap and/or the container body and/or the collar and/or a separate component, for example. Preferred sealing means include sealing flanges and/or other sealing members, for example gaskets and the like. Another possible sealing member is a membrane seal, for example comprising a metal foil seal (e.g. formed from aluminium foil), which may optionally be provided with one or more polymer layers on one or both major surfaces thereof. The foil seal may provide an excellent gas barrier, for example. Advantageously, the use of a metal foil seal may enable the formation of a seal by induction heating, e.g. by bonding one or more polymer layers to the container body and/or to the cap. The foil seal or other membrane seal may be provided on the cap and/or the container body and/or the collar and/or separately.

The container and its components may be made from any suitable material, including metal and/or glass and/or polymer material. Polymer materials are generally preferred for the cap and the collar, especially polyolefins, e.g. polyethylene or polypropylene. The container body preferably is formed from glass or polymer material, especially a polyolefin, e.g. polyethylene terephthalate (PET). The polymeric components preferably are formed by moulding, especially injection moulding and/or blow moulding.

References to directions such as upwards, downwards, vertically, etc. used herein should be understood as referring to directions relative to a container when standing upright on a horizontal surface.

BRIEF DESCRIPTION OF DRAWINGS

The invention will now be further described, merely by way of example, with reference to the accompanying drawings, in which:

Figure 1 is an exploded view of the components making up a first embodiment of a container and closure therefore according to the invention;

Figures 2A and 2B are perspective views from above and below of the container shown in Figure 1, and Figure 3 in a vertical section through a wall of the container;

Figures 4 and 5 are perspective views from above and below of a first part of the closure shown in Figure 1;

Figure 6 is an enlarged, horizontal sectional view of the first part of the closure viewed from above;

Figures 7 and 8 are perspective views from above and below of a second part of the closure shown in Figure 1;

Figure 9A is a vertical sectional view of the container and closure when assembled together, with the closure in sealing engagement with the container, and Figure 9B is an enlarged view of part of Figure 9A;

Figure 10A is a vertical sectional view of the container and closure when assembled together with the closure ready for removal from the container, and Figure 10B is an enlarged view of part of Figure 10A;

Figure 11A is a plan view of first and second parts of the closure formed as one piece, Figure 11B is an enlarged view of the connection between the two parts and Figures 11C-11E illustrate how the second part is pivoted into location within the first part;

Figures 12A-12C illustrate a second embodiment of a container according to the present invention having a cap without apertures formed therethrough: Figure 12A is a perspective view of the cap from above,

Figure 12B is a partial, perspective showing the interior of the cap and Figure 12C is a side view of the cap when secured to a container body;

Figures 13A-13C illustrate a modified form of container body which may be used in other embodiments of the invention having a stop member beneath a lip of the container instead of a stop member in the form of a recess in the container wall: Figure 13A is a perspective view of such a container body and Figures 13B and 13C are enlarged, perspective views of the stop member showing the two ends thereof;

Figures 14A-14D illustrate a modified form of collar which may be used in other embodiments of the invention: Figure 14A is a perspective view of the collar from above, Figures 14B and 14C are enlarged, perspective views of part of the collar viewed from the interior thereof and Figure 14D is an enlarged, perspective view of part of the collar viewed from the exterior thereof;

Figure 15 is a cross-sectional view of part of a collar of the type shown in Figure 14 when assembled with a cap onto a container body;

Figures 16A-16D illustrate modified forms of a cap and collar having a venting feature which may be used in other embodiments: Figure 16A is a perspective view from beneath of the cap and Figure 16B an enlarged view of part thereof; Figure 16C is a perspective view from beneath of the collar and Figure 16D an enlarged view of part thereof;

Figures 17A-17F are schematic views illustrating how the cap and collar of Figure 16 interact at different rotational positions thereof;

Figures 18A and 18D show perspective views from above and beneath of a further modified form of a collar which may be used in other embodiments of the invention;

Figures 19A and 19B show perspective views from above and beneath of a cap that may be used with the collar of Figure 18;

Figure 20 is a perspective view of a modified form of container which may be used with the collar and cap of Figures 18 and 19, the container having a stop feature formed in a lip thereof;

Figures 21A and 21B are cross-sectional views of the collar, cap and container of Figures 18, 19 and 20 when assembled together illustrating two positions of a first part of the collar;

Figures 22A and 22B are cross-sectional views of the collar, cap and container of Figures 18, 19 and 20 when assembled together illustrating two positions of a second part of the collar;

Figure 23A is a perspective view from beneath of the cap and collar when in the position shown in Figures 21A and 22A and Figure 23B is a perspective view from beneath of the cap and collar when in the position shown in Figures 21B and 22B; and

Figures 24A-24C illustrate a seal within the cap which maybe used in some embodiments of the invention: Figure 24A is a perspective view from beneath of a cap and collar with a seal mounted therein; Figure 24B is a cross-sectional view of Figure 24A; and Figure 24C is an enlarged view of part of Fig 24B.

DESCRIPTION OF PREFERRED EMBODIMENTS

Figures 1-10 illustrate a wide mouth container and closure which is particularly suited to holding and transporting a sparkling beverage and, once opened, the container provides a vessel from which a user can comfortably drink. The closure may also be re-applied to the container should the user only consume part of the beverage and wish to re-seal the container for later use.

The illustrated container 1 comprises a wall 2 with a lip 3 around its upper end defining a wide mouth opening 4 which defines an axis and through which the container 1 can be filled and through which a beverage can be dispensed or consumed.

The closure comprises a cap 5 having an upper circular portion 5A for closing the opening 4 of the container and a skirt portion 5B depending from the perimeter of the circular portion 5A. The closure also comprises a collar 6 in the form of a ring with a plurality of circumferentially spaced apart flaps or legs (or other radially moveable parts) 7 extending therefrom. Figure 1 also shows a sealing member in the form of a disc 8 of flexible material which, in use, is sandwiched between the circular portion 5A of the cap and the lip 3 of the container to provide a seal therebetween. Other forms of sealing members may be used. In particular, the underside of the circular portion 5A and/or the inner surface of the skirt portion 5B may be provided with features which, in use, are pressed against parts of the container so as to provide a seal therewith.

As shown in Figures 2-3, the mouth of the container has a particularly simple and clean form compared to containers such as those described in WO-2006/000774. The lip 3 has a smooth, curved outer surface 3A and a substantially flat, horizontal underside 3B which provides an axially facing surface on the container. The exterior wall 3 of the container 1 is also generally smooth and free of features apart from one or more small depressions or recesses 2A at positions spaced from the lip 3. Typically, the recesses 2A may be 2-5mm wide (in the direction of the circumference of the container) and 2-5mm high (in a direction parallel to the axis of the container) and less than 1-2mm deep (in a radial direction). Preferably, a small number of recesses 2A are provided at spaced apart locations around the circumference of the container, e.g. two at 180 degree spacing, three at 120 degree spacing or four at 90 degree

spacing. The recesses 2A are spaced from the lip 3 by a distance corresponding to, but slightly less, than the length of the skirt portion 5B of the cap 5 (in a direction parallel to the axis of the cap). Typically, for this type of container, the recesses 2A may be 4-7mm beneath the underside of lip 3. The container 1 thus has a mouth which is comfortable to drink from in the manner of a conventional glass or drinking vessel.

In the illustrated embodiment, the recesses 2A are provided on a part of the container 1 having a diameter approximately equal to the maximum diameter of the lip 3. This helps ensure that the collar is easily removable from the container when the container is opened.

Whilst the external wall 2 of the illustrated container tapers inwards slightly towards the upper end of the container, the shape of the container wall, the lip and the recesses are such that the container can be manufactured by an injection moulding process. The containers described in WO 2006/000774 are designed to be fabricated by a two-stage process, a first stage in which the mouth and neck features are formed in a pre-form by injection moulding and a second stage in which the remainder of the container is formed by blow-moulding the pre-form. The containers described herein have the advantage that, if desired, they can be made entirely by an injection moulding process. One reason for this is that the size of the mouth of the container has been increased so that the container can be formed with the required volume (e.g. 1 pint or 568ml) without the need for a bulbous shape (for which a blow-moulding technique is required). In addition, (as described further below) as all the flaps 7 are urged outwards by means of a cam on the cap 5 when the closure is to be opened (or, alternatively, all flaps 7 are able to move outwards under their own resilience), instead of the flaps 7 being urged outwards by a camming action over the container lip, it is possible to increase the surface area of engagement between the shoulders 7C and the underside 3B of the lip without prejudicing the ease of removal of the cap. Thus, by increasing the security of the attachment of the closure to

the container without making the closure harder to remove, it is possible to increase the diameter of the container mouth without increasing the risk that the closure will blow off due to high internal pressures. This gives rise to greater flexibility in the design and shape of the container and hence greater flexibility in the way it can be manufactured. Indeed, if desired, the external wall of the container towards the upper end therefore may be parallel sided or even taper outwards. However, the containers described herein may also be manufactured by the two-stage process of injection moulding and blow moulding if desired.

A further advantage of the container 1 described herein is that it can be shaped so as to be nestable with other similar containers. This provides a significant space saving when empty containers are stored or transported.

Figures 4 and 5 illustrate the shape of the cap 5 used to close the container 1. The upper surface of the circular portion 5A of the cap may be smooth and, in use, branding information may be provided thereon (either directly on the cap or by means of a label affixed thereto). The exterior surface of the skirt portion 5B is provided with ribs 5C, or other formations, to provide more grip for a user's hand. These may be formed by grooves in the skirt portion 5B and/or by ribs projecting therefrom. It will also be seen that a plurality of spaced apart apertures 5E are provided around the circumference of the skirt portion 5B, typically between six and twelve equi-angularly spaced apertures 5E are provided. In the example illustrated, nine apertures are provided at 40 degree intervals around the circumference of the cap.

The inner surface of the cap 5 is provided with a number of features. First, a plurality of spaced apart thread features 5F are provided adjacent the lower end of the skirt portion 5B. Secondly, a plurality of first circumferentially spaced apart cam features 5G are provided adjacent the upper end of the skirt portion 5B (where it joins the circular portion

5A). Each of the thread features 5F and each of the first cam features 5G are aligned with a respective one of the apertures 5E. Thirdly, a plurality of second circumferentially spaced apart cam features 5H are provided adjacent the outer perimeter of the circular portion 5A so as to alternate with the first cam features 5G.

The functions of these various features will be described further below. However, it should be noted that the cap 5 is designed so that it can be manufactured using a straight up and away injection moulding tool (rather than requiring the use of collapsible cores as for the cap disclosed in WO 2006/000774). This is facilitated by the provision of the apertures 5E as parts of the injection moulding tool used to form the thread features 5F can pass through the apertures 5E.

Figures 6 and 7 illustrate the shape of the collar 6 which is used to enable the cap 5 to be secured to the container 1. The collar comprises a ring with a plurality of circumferentially spaced apart flaps 7 extending upwardly therefrom. The number of flaps 7 corresponds to the number of apertures 5E, thread features 5F, and first and second cam features 5G, 5H used in the cap 5. Each of the flaps 7 has an outer surface 7A for engaging the first cam features 5G, an inner surface 7B for engaging the second cam features 5H, and a shoulder 7C for engaging under the lip 3 of the container. The width of the flaps 7 (in the circumferential direction) is typically such that the combined width of all the flaps occupies up to about 50% of the circumference of the collar 6.

The collar 6 also has inwardly directed projections 9 for engaging in the recesses 2A in the external surface of the container. Preferably, the number of projections 9 corresponds to the number of recesses 2A but this need not be the case. In a preferred arrangement, each projection 9 is provided at the distal end of a circumferentially extending resilient arm 9A provided on the inner side of the collar 6. By this means, the projections 9 are able to maintain their engagement with the respective

recesses 2A even if the collar 6 and/or the container 1 is held in a manner which causes the collar and/or the container to assume a slightly oval, rather than circular, shape.

The collar 6 is also provided with a series of stops 10 which limit the extent by which the collar 6 can be rotated relative to the cap 5 by engaging end faces of the thread features 5F (or other features) on the cap 5.

The collar 6 is also arranged to engage the thread features 5F of the cap 5 in a manner such that upon rotation of the cap 5 in the tightening direction relative to the collar 6, the cap 5 is moved axially relative to the collar 6 so it can be brought into sealing contact with the lip 3 (via a sealing member 8 if present). In the illustrated embodiment, the underside of the collar 6 engages with an upper surface of the thread features 5F, the engaging parts being shaped so as to provide axial movement, e.g. of 0.5 – 1.0mm, upon rotational movement, e.g. of 20-40 degrees therebetween.

In the embodiment shown, the upper surface of the thread feature 5F has an inclined (at about 10 degrees) lead-in surface 5J following by a substantially horizontal surface 5K and these engage with an inclined (again, at about 10 degrees) surface 6B provided on the underside of the collar 6 which also leads onto a substantially horizontal surface 6C.

To assemble the container and closure, the collar 6 is preferably first fitted into the cap 5. Once fitted therein, the collar 6 is recessed within the cap 5 and does not project beyond the end of the skirt portion 5B (unlike the arrangements described in WO 2006/000774). This improves the appearance of the closure and the user need not handle the collar 6 when operating the closure. The sealing member 8 (if used) may be assembled in the cap 5 either before or after assembly of the collar 6 with the cap 5.

The collar 6 is initially assembled with the cap 5 with the flaps 7 lying in spaces between the apertures 5E of the cap 5. The collar 6 can be easily mounted within the cap 5 in this position by axially inserting the collar 6 into the cap 5 so the flaps 7 pass between the thread features 5F until the lower surface 6A of the collar 6 engages the upper surfaces of the thread features 5F. The inward facing surfaces of the thread features 5F are chamfered to assist the collar 6 in riding over these features until the collar 6 snaps into place behind the thread features 5F.

In this initial position, the inner surfaces 7B of the flaps engage the second cam features 5H such that the flaps 7 are urged to a radially outward position whereby the cap 5 with collar 6 assembled therein can be installed axially onto container 1; the flaps 7 being held at a diameter similar to or preferably slightly greater than the maximum diameter of the lip 3. The cap 5 and collar 6 are then rotated on the container (in either direction) until the projections 9 engage in the respective recesses 2A. Engagement of the projection 9 in the recesses 2A effectively prevents or restricts further rotation of the collar 6 relative to the container 1 (the projection 9 and recesses 2A each being provided with substantially flat vertical sides which engage each other to prevent such rotation).

If the cap 5 is then rotated in the tightening direction (clockwise when viewed from above), the cap 5 rotates relative to the collar 6 and the container 1. During this rotation, the thread features 5F of the cap 5 slide over the underside of the collar 6 so that the cap 5 is axially tightened down onto the lip 3 of the container so as to seal the opening 4 of container. At the same time, rotation of the cap 5 relative to the collar 6 moves the flaps 7 out of engagement with the second cams 5H and into engagement with the first cam features 5G which causes the flaps 7 to be urged to a radially inward position in which the shoulders 7C of the flaps are engaged with the underside 3B of the lip 3. By this means, the collar 6, and hence the cap 5, is securely held on the container 1.

Figures 9A and 9B show the closure in this position with the collar 6 fitted between the cap 5 and the container 1 with the axes of the cap, collar and container aligned with each other. As will be seen, the shoulders 7C are engaged under the lip 3 and are held in this position by the first set of cams 5G. The upper surface of the thread features 5F are in the tightened position with the lower axially facing surface 6A of the collar 6 whereby the circular portion 5A of the cap is drawn down into sealing engagement with the lip 3 (via sealing member 8).

To remove the closure, the cap 5 is rotated in the loosening direction (anti-clockwise when viewed from above) relative to the collar 6 and the container 1 whereby the flaps 7 move out of engagement with the first set of cams 5G and into engagement with the second set of cams 5H whereby the flaps 7 are urged radially outwards. Once they reach a radial position in which the shoulders 7C are no longer engaged beneath the lip 3, the cap 5 and collar 6 are free to be lifted axially away from the container 1. During this unscrewing movement, the collar 6 is rotated relative to the thread features 5F so that the cap 5 is no longer urged downwards into tight engagement with the lip 3. The cap 3 is thus free to lift slightly, eg due to elevated pressure within the container, in order to vent the container. This is preferably arranged to occur before the flaps 7 are fully disengaged from the lip 3 to reduce the risk of the cap 5 missing away from the container 1. Alternatively, other venting means (not shown) may be provided to reduce this risk. Venting the internal pressure also helps reduce the torque required to unscrew the cap 5.

Upon unscrewing the cap a weak point in the skirt portion 5B is ruptured so as to provide tamper evidence. This may be caused by providing interengaging parts on the external surface of the collar 6 and internal surface of the skirt portion 5B of the cap (or small spot-welds therebetween) which engagements have to be overcome to unscrew the

cap 5 giving rise to rupture of the skirt portion 5B (or some other tamper evident feature).

The upper surfaces of the recesses 2A are preferably angled so the projections 9 can disengage therefrom relatively easily as the cap 5 and collar 6 are lifted off the container 1. The upper and lower surfaces of the projection 9 are also chamfered to assist their movement into and out of the recesses 2A in a vertical direction when the closure is placed on and removed from the container 1.

Figure 10B shows the closure in a position ready to be removed from the container 1. The flaps 7 are held in a radially outward position by the second cams 5H so the shoulders 7C of the flaps 7 are disengaged from the underside of the lip 3. The figure also shows the cap having lifted slightly relative to the collar 6 and container 1 so the sealing member 8 is no longer held in sealing engagement with the lip 3.

The first and second cam features 5G and 5H effectively form a chicane pathway through which the flap 7 passes as the cap 5 is rotated on the collar 6 (as best shown in Figure 6). The flap 7 is initially urged outwards by cam 5H then, as the cap is rotated, the flap 7 disengages the cam 5G and the opposite side of the flap 7 is engaged by the first cam 5G which urges it inwards. By urging the flap inwards and outwards in this manner, they are reliably and positively moved to the required radial positions. Alternatively, the resilience of the flaps 7 may be relied upon to move them in at least one direction (i.e. either inwards or outwards). However, this does not provide the same positive movement provided by the chicane camming arrangement and if the flaps 7 are held in one position for an extended time they may lose their resilience and so may not operate reliably.

The flaps 7 may be formed with a resilient connection, e.g. a living hinge, with the ring so that they can flex inwards and outwards with a reduced tendency to twist the ring.

As shown in Figure 6, the first cams 5G comprise relatively long ramps at each end (although only one end is involved in the camming action) separated by a relatively long plateau area whereas the second cams 5H comprise curved surfaces at each end separated by a relatively short plateau area.

If desired, the closure can be re-fitted to the container 1 by axially pressing it onto the lip 3, rotating to engage the projections 9 with the location recesses 2A then rotating the cap 5 to seal it onto the lip 3.

It will be appreciated that in the sealed position, the flaps 7 are located in alignment with the apertures 5E whereas when the cap 5 has been loosened ready for removal, the flaps 7 no longer occlude the apertures. This provides a visual indication as to whether the cap 5 is in a sealed or ready to remove position. If desired, the flaps 7 may be coloured to enhance this visual indication.

Figure 11 illustrates how the cap 5 and collar 6 may be manufactured as a single component, e.g. by injection moulding, and then assembled together.

Figure 11A shows a plan view of the cap 5 and collar 6 as manufactured, side by side with interconnecting parts 11. Figure 11B shows the interconnecting parts 11 in more detail. The cap 5 and collar 6 can be hinged about the interconnecting parts 11 such that they pass through slots 11A formed in the skirt portion 5B of cap 5.

Figures 11C-11E illustrate how the collar 6 is hinged about the interconnecting parts so as to assemble the collar 6 into the cap 5 to a

position corresponding to that shown in Figure 10 ready for placing the closure onto the container 1.

Having assembled the collar 6 into the cap 5 in this manner, the interconnecting parts 11 are severed so the cap 5 can rotate relative to the collar 6. One way of doing this, is to make the interconnecting parts 11 sufficiently thin so that as the cap is rotated, the skirt portion 5B thereof ruptures the interconnecting parts 11 at the point where they pass through the slots 11A in the skirt portion 5B.

The illustrated container has, as mentioned above, a number of advantages over the containers described in WO2006/00774. The illustrated container is designed to be much easier to manufacture. It has a simpler form and, in some case, requires 30% less material so substantially reducing the cost of manufacture.

Figures 12A and 12C illustrate a second embodiment of a container according to the present invention. The container again comprises a container body 21 with an external wall 22 and a closure comprising a cap 25 and a collar (not shown in Figure 12) by means of which the cap is secured to the container body 21.

The cap 25 and collar are similar to those described above with reference to Figures 5-8 but in this case the cap 25 is not provided with apertures corresponding to the apertures 5E shown in Figures 4 and 5.

Figures 12A and 12B show perspective views from above and beneath of the cap 25. The cap 25 is provided with a plurality of spaced apart thread features 25F, a plurality of first circumferentially spaced apart cam features 25G and a plurality of second circumferentially spaced apart cam features 25H similar to the corresponding parts of the cap described in relation to Figures 4 and 5. The cam features 25G have a series of grooves formed therein to reduce the amount of plastic used in

the cap, and hence reduce its weight, but function in a similar manner to those described in relation to Figures 4 and 5.

As the cap 25 is not provided with apertures to enable the thread features 25F to be formed using a straight up and away injection moulding tool these features are instead formed using a collapsing core to create the undercuts of these parts.

Figures 13A-13C illustrate a modified form of the container body 31. The illustrated container body 31 has a lip 33 around its upper end which defines a wide mouth opening 34. In order to limit rotational movement of the collar (not shown) relative to the container body 31, two small stop members 31A are provided on the underside of the lip 33 each having a tapered form 31B at one end and a flat face 31C at the other end (but arranged in opposite orientations).

A feature on the collar (not shown) is arranged to engage one of the stop members 31A (depending on which direction the rotation occurs) so rotation of the collar relative to the container is limited when the cap is rotated to secure it to the container or to remove it from the container. Said feature on the collar is able to ride over the tapered end of the stop member 31A in one direction but is brought to a halt when it engages the flat face 31C of one of the stop members.

It will be appreciated that these stop members are thus an alternative to providing a recess 2A in the container wall as described in the embodiment shown in Figures 1-3.

Figures 14A-14D illustrate a modified form of collar 46 which may be used in one or more of the embodiments described herein. The collar 46 has a plurality of circumferentially spaced apart flaps 47 extending upwardly from a ring part 46A of the collar. Each of the flaps 47 comprises an outer surface 47A for engaging a first set of cam features of

the cap (such as the cam features 25G shown in Figure 12B), an upstanding tab 47B the inner surface of which engages a second set of cam features of the cap (such as the cam features 25H shown in Figure 12B) and a shoulder 47C for engaging under the lip of a container (such as the lip 33 shown in Figure 13).

As in the embodiment described above, the first and second sets of cam features 25G and 25H drive the flaps 47 radially inwards and radially outwards upon rotation of the cap 25 relative to the collar 46 so as to engage the shoulders of the flaps under the lip of the container 31 and disengage them therefrom. The flaps 47 thus follow a chicane pathway as the cap 25 is rotated relative to the collar 26.

In this form of collar 46, the flaps 47 are recessed axially with respect to the ring part 46A of the collar, ie. the lower end or root 47D of the flap is connected to the ring part 46A at a point beneath an upper surface 46B of the ring part 46A. This is best illustrated by a section through the collar 46 as shown in Figures 14C and Figure 15. One advantage of this is that the overall height of the collar 46 (in the axial direction) can be reduced.

In this form of collar 46, thread features 48 are provided by axially facing surfaces projecting from (or formed by recesses in) the external circumferential surface of the ring part 46A of the collar (whereas in Figure 7 they are provided, at least partially, by axially facing surfaces on the underside of the collar 6). As in the embodiment described above, the thread features 48 of the collar engage with thread features of the cap (such as the features 25F shown in Figure 12B) to retain the collar 46 within the cap 25 and so that, upon relative rotation therebetween, the collar 46 is moved axially relative to the cap 25. Further details of such thread features are described below with reference to Figures 16 and 17.

As shown in Figure 14, in this embodiment, the thread features 48 overlap in the axial direction with at least part of the flaps 47. However, as there is a gap 46C between the outer surface of the flap 47 and the inner surface of the parts of the ring part 46A in line with the flaps 47, the flaps 47 are still able to flex radially outwards (as best shown in Figure 21A and described further below).

In the embodiment illustrated in Figure 14, the collar 46 has nine flaps 47 at circumferentially spaced positions therearound. At least one, and preferably three, of these flaps has a separate, smaller, radially moveable flap (or arm) 49 adjacent thereto as shown in Figure 14B. Each radially moveable flap 49 has a projection 49A which projects radially inwards for engaging with a retaining feature of a container body so as to limit the relative rotation between the collar 46 and the container body. The projection(s) 49A may, for example, be designed to engage one or more recesses in the container body (such as recess 2A shown in Figure 2) or one or more stop members provided on the underside of the lip of the container body (such as stop members 31A shown in Figure 13).

The projections 49A preferably have a tapered form so that when the collar is rotated in one direction relative to the container body (e.g. the tightening direction), it is able to ride over the corresponding feature on the container body causing the flap 49 to flex radially outwards but when rotated in the opposite direction (e.g. the loosening direction) a face of the projection 49A engages a face of the said feature (e.g. the face 31C shown in Figure 13B) to limit further rotation of the collar 46 relative to the container body.

Figure 15 is a partial, cross-sectional view of the cap 25 of Figure 12A and 12B, when mounted on the container body 31 of Figure 13 by means of the collar 47 of Figure 14. The Figure shows the shoulder 47C of the collar 46 engaged beneath the lip 33 of the container 31 and shows

a thread feature 25F of the cap 25 engaged with a thread feature 48 of the collar 46.

Figures 16A-16D show a further modified form of a cap 55 and collar 56 which are similar to the cap and collar shown in Figures 12 and 14 but in which the thread features 55 and 58 of the cap 55 and collar 56 have a specific form to assist in venting the container as the closure is loosened prior to removal from the container.

Each of the thread features 55F of the cap 55 are provided with an additional small projection, or pip 55G, projecting upwardly therefrom with a steep slope on one side therefrom and a shallow slope on the other side thereof.

Each of the thread features 58 of the collar 56 comprises a first, substantially horizontal surface 58A, a second, inclined surface 58B and a third substantially horizontal surface 58C (similar to corresponding surfaces of the embodiments described above). A cut-out, or scallop 58D, is, however, formed part way along the third surface 58C for receiving the pip 55G of the thread feature 55F of the cap 55.

Each of the thread features 58 of the collar 56 also has a steeply inclined surface 58E, a more shallowly inclined surface 58F and an end surface 58G. These surfaces will be described further below.

Another minor difference between the cap 55 shown in Figure 16A and that shown in Figure 12B is that instead of a series of grooves being formed in the first cam features 35G to reduce weight, a rectangular recess is formed in the first cam members 55H (for the same reason).

Figures 17A and 17F schematically illustrate how the thread features of the cap 55 and collar 56 interact as the cap is first turned in

the tightening direction (Figures 17A to 17C) and then as it is loosened (Figures 17D to 17F) for removal.

Figure 17A shows the location of thread feature 55F after the collar 56 has been axially located within the cap 55. As the cap 55 is turned in the tightening direction (clockwise when viewed from above), thread feature 55F moves from surface 58A, along surface 58B (whereupon the cap is drawn down onto the container mouth) and along surface 58C (Figure 17B) until the end of thread feature 55 reaches stop surface 58G (as shown in Figure 17C). During this movement, pip 55G passes scallop 58D without difficulty due to the shallow slope of its leading edge.

When the cap is rotated in the loosening direction (anti-clockwise when viewed from above), it moves from the position shown in Figure 17C, along surface 58C until the pip 55G engages scallop 58D (this position is typically reached following rotation of about five degrees) as shown in Figure 17D. If the container contains a carbonated beverage (or is otherwise at an elevated pressure), the pressure in the container raises the cap by a small distance, typically about 0.5mm, as the pip 55G enters the scallop 58D. This enables the pressure in the container to reduce by venting through the small gap thus created between the cap and the container body. It will be appreciated that engagement of the pip 55G in the scallop 58D resists further rotation of the cap in the unscrewing direction (particularly if the pressure in the container is high so the pip is pressed into the scallop) due to the steep slope on the leading side of the pip when being turned in this direction.

After gassing-off has occurred, further rotation of the cap 55 in the loosening direction (which is now easier due to the reduced pressure within the container) moves the pip 55G out of the scallop 58D and further along surface 58D (Figure 17E) and then to the position shown in Figure 17F (which is the same as that shown in Figure 17A) from where the cap is ready for removal from the container. To assist in moving the pip

55G out of the scallop 58D, the cap 55 is preferably pressed axially towards the container body until the pip is released from the scallop.

It will be appreciated that whilst the thread features described above permit gassing off by allowing a small axial movement of the cap, the cap is unable to be removed from the container (or be propelled off the container by the pressure therein) in the position shown in Figure 17D as the cam features 55H still hold the flaps 57 of the collar 56 firmly under the lip of the container in this angular position and further rotation of the cap 55 is blocked or restricted by engagement of the pip 55G in the scallop 58D. The risk of "missiling" of the cap is thus significantly reduced.

It should be noted that the inclination of surfaces 58E and 58F is not critical. They are shown as corresponding to the upper surfaces of thread feature 55F so as to engage therewith in the fully tightened position shown in Figure 17C. However, this is not necessary and the thread feature can be prevented from being over-tightened simply by engagement with the stop surface 58G.

Figures 18A and 18B show perspective views from above and beneath of a further modified form of collar 66 that may be used in preferred embodiments of the invention. This is similar to the collar shown in Figure 16C except that it has only eight (instead of nine) flaps 67 at spaced apart locations around its circumference. This enables two smaller radially moveable flaps 69 (which provide a similar function to the smaller flaps 49 described in relation to Figure 14) to be provided at diametrically opposite positions. It also further reduces the weight of the collar 66. Similarly, the collar 66 only has eight thread features 68 rather than nine.

Whilst Figure 18 shows a collar having two such smaller flaps 69, it would also be possible to use just one such flap or, indeed, three or more such flaps. The preferred number is, however, two.

Figures 19A and 19B show perspective views from above and beneath of a cap 65 for use with the collar shown in Figure 18A and 18B. Cap 65 is similar to that shown in Figure 16 except that it only has eight thread features 65F, eight first cam features 65E and eight second cam features 65H at spaced apart locations around its circumference (rather than nine). As will be described further below, this enables the second set of cam features 65H to provide a second function, namely to drive parts of the collar 66 into secure engagement with the container (see description of Figure 22B below).

The cap 65 and collar 66 of Figures 18 and 19 may be used with a container body of the types described above. Alternatively, they may be used with a further form of container 71 such as that shown in Figure 20. This container comprises a stop feature in the form of a small recess or cut-out 71A in a lip 73 around the mouth 74 of the container. Two such recesses 71A may be provided, e.g. at diametrically opposite positions.

Figures 21A and 21B are cross-sectional views showing the cap 65 of Figure 18 when mounted on the container 71 of Figure 20 by means of the collar 66 of Figure 19 showing flaps 67 in a radially outward position (Figure 21A) and in a radially inward position (Figure 21B).

Figure 22A and 22B are similar but show a smaller flap 69 in a first position in which it is free to move radially outwards (Figure 22A) and in a second position in which it is held in a radially inward position (Figure 22B).

Figure 21A shows the position of the collar 66 when the closure has just been mounted on the container 71 (or when it is ready for removal

therefrom). In this position, tab 47B of the flap 47 is engaged with the outer surface of a second cam feature 65H of the cap 65 so that the flap 67 is held in a radially outward position. In this position, a shoulder 67C of the flap is disengaged from the lip 73 of container 71 so the closure (comprising the cap and collar) is free to be removed from the container 71. In this position, thread feature 65F of the cap 65 is aligned with a gap between two adjacent flaps 67 of the collar 66 (so does not lie in the section shown in Figure 21A).

Figure 21B shows the position of the collar 66 when the cap 65 has been rotated so as to secure it to the container 71. In this position, an outer surface of flap 67 is engaged with inner surfaces of a first cam feature 65G of the cap so that the flap 67 is urged to a radially inward position. In this position, the shoulder 67C of the flap is engaged beneath the lip 73 of the container 71 so the closure is secured to the container 71. The section of Figure 21B also shows the thread feature 65F of the cap 65 engaged with the thread feature 68 of the collar (in a position corresponding to that shown in Figure 17C).

Figure 22A shows the closure in a position in which it is free for removal from the container (as in Figure 21A) but shows a section through a smaller flap 69 of the collar 66. Whilst the flap 69 is not driven to a radially outward position (like the flap 67 in Figure 21A) it is free to flex outwardly in this position so that as the closure is mounted on, or removed from, the container 71, the flap 69 is able to flex past the lip 73 of the container.

However, in the position shown in Figure 22B, the smaller flap 69 is held in a radially inward position by an inner surface of cam feature 65H of the cap so that it cannot disengage from the recess 71A (see Figure 20) in the lip 73 of the container 71. Thus, in this position, the collar 66 is held in positive engagement with the container. As shown in Figures 21

and 22, the majority of the collar 66 is recessed within the cap 65 although the lower edge thereof may project beyond the skirt of the cap 65.

Figure 23A is a perspective view of the cap 65 and collar 66 when assembled together in the position shown in Figures 21A and 22A (but shown in the absence of a container 71). As described above, in this position, the flaps 67 are urged radially outwards by second cam features 65H and flaps 69 lie adjacent first cam features 65G but are spaced therefrom so they are free to be flexed radially outwards.

Figure 23B is a perspective view of the cap 65 and collar 66 when assembled together in the position shown in Figures 21B and 22B (but again without a container). As described above, in this position, the flaps 67 are urged radially inwards by first cam features 65G and flaps 69 are urged inwards, or at least prevented from moving radially outwards, by an inner surface of second cam features 65H. The second set of cam features 65H thus provide two functions: they assist in holding the flaps 69 inwards when the cap 65 is in the secured position and they drive the flaps 67 outwards when the cap 65 is rotated to the release position.

Figures 24A-24C illustrate a seal that may be mounted in the cap 85 to assist in forming a gas-tight seal between the underside of the cap 85 and the container 83. The seal 90 comprises a disc of flexible material and is held in place by locating an aperture in the centre of the disk 90 over a flared projection 85D provided in the centre of the underside of the cap 85.

Figure 24A shows a perspective view of a cap 85 and collar 86 similar to Figure 23A but with the seal 90 mounted therein.

Figure 24B is a sectional view across a diameter of the cap and collar shown in Figure 23B and Figure 24C shows an enlarged view of the

location of the seal 90 over the flared projection 85D on the underside of the cap 85.

The various features described in Figures 12-24 provide improvements and/or alternatives that may be used in preferred embodiments of the invention.

CLAIMS

1. A container comprising a container body including a circular opening which defines an axis, a cap to close the opening and a collar, the cap comprising an annular skirt portion having a plurality of spaced apart projections around its inner circumference and the collar comprising a ring with a plurality of spaced apart flaps, or other radially moveable parts, provided thereon, the collar being arranged to fit between the container body and cap with their axes aligned such that said projections respectively engage axially facing surfaces of the ring and the flaps or other radially moveable parts engage an axially facing surface of a lip (or other features) of the container body whereby the cap can be secured to the container body.
2. A container as claims in Claim 1 in which said projections on the cap and said axially facing surfaces of the ring provide a threaded engagement between the cap and collar whereby rotation of the cap relative to the collar in a tightening direction draws the cap into sealing engagement with the container body.
3. A container as claims in claim 1 or 2 in which the collar has one or more inwardly directed projections for engaging on or move features of the container body whereby rotation of the collar relative to the container body when the cap is turned in a loosening direction is limited.
4. A container as claims in claim 3 in which said inwardly directed projection is provided on a resilient arm which extends substantially vertically from said ring.
5. A container as claimed in claim 4 in which said inwardly directed projection is prevented from moving radially outwards by a part of the cap when the cap is in the fully secured position.

6. A container as claimed in any preceding claim in which said flaps, or other radially moveable parts, extend in a substantially axial direction from said ring.
7. A container as claimed in claim 6 in which said flaps, or other radially moveable parts, extend from an upper surface of said ring.
8. A container as claimed in claim 6 in which said flaps, or other radially moveable parts, overlap (at least to some extent) with said ring in the axial direction.
9. A container as claimed in claims 7 or 8 in which said flaps, or other radially moveable parts, have an inwardly projecting shoulder for engaging said axially facing surface of the lip (or other features) of the container body.
10. A container as claimed in claims 7, 8 or 9 in which the cap has a first set of cam surfaces for urging the flaps or other radially moveable parts radially inwards to engage the container body and a second set of cam surfaces for urging the flaps or other radially moveable parts radially outwards to disengage from the container body upon rotation of the cap relative to the collar.
11. A container as claimed in claim 10 in which the cams of the first and second sets of cam surfaces are arranged alternately around an inner surface of the cap and rotation of the cap relative to the collar moves the flaps or other radially moveable parts from engagement with the first set of cam surfaces into engagement with the second set of cam surfaces.
12. A container as claimed in any preceding claims in which the cap, the collar and the container body are constructed and arranged to provide a vent for venting gas from the container body, at least when the cap is in an intermediate position (between fully secured and fully released).

13. A container as claimed in claim 12 in which the collar and the cap include means to block or restrict removal of the cap from the collar beyond an intermediate position (between fully secured and fully released) when the cap is under an axial pressure in a direction emerging from the container body.
14. A container comprising a container body including an opening, a cap to close the opening and a collar arranged to fit between the container body and the cap, the collar having a plurality of spaced apart flaps or other radially moveable parts provided thereon and the cap having a first set of cam surfaces for urging the flaps or other radially moveable parts radially inwards to engage the container body and a second set of cam surfaces for urging the flaps or other radially moveable parts radially outwards to disengage from the container body upon rotation of the cap relative to the collar.
15. A container as claimed in claim 14 in which the cams of the first and second sets of cam surfaces are arranged alternately around an inner surface of the cap and rotation of the cap relative to the collar moves the flaps or other radially moveable parts from engagement with the first set of cam surfaces into engagement with the second set of cam surfaces.
16. A container as claimed in claims 14 or 15 in which the collar comprises a ring from which said flaps, or other radially moveable parts, extend in a substantially axial direction.
17. A container as claimed in any of claims 14, 15 or 16 in which the collar has one or more inwardly directed projections for engaging one or more features of the container body, said projection being provided on a resilient arm which is prevented from flexing radially outwards by a part of the cap when the cap is in the fully secured position.

18. A container as claimed in claim 17 in which said part of the cap also provides one of said second set of cam surfaces.

19. A container comprising a container body including an opening, a cap to close the opening and a collar, the collar being arranged to fit between the container body and the cap so as to secure the cap to the container body, the collar having one or more inwardly directed projections for engaging one or more features of an external surface of the container body whereby rotation of the collar relative to the container body is limited, said one or more projections being provided on a resilient arm extending from said collar so as to be radially moveable into the out of engagement with said one or more features of the external surface of the container body.

20. A container as claimed in claim 19 in which said inwardly directed projection is provided on a resilient arm which extends substantially vertically from said ring.

21. A container as claimed in claim 20 in which said inwardly directed projection is prevented from moving radially outwards by a part of the cap when the cap is in the fully secured position.

22. A container comprising a container body including an opening, a cap to close the opening and a collar arranged to fit between the container body and the cap, the cap being rotatable relative to the collar between a first position in which the cap is secured to the container body via the collar and a second position in which the cap is removable from the container body, the cap being secured to the collar by a threaded engagement therebetween, said threaded engagement being arranged to provide a vent for venting gas from the container body, at least when the cap is in an intermediate position (between fully secured and fully released).

23. A container as claimed in claim 22 in which said threaded engagement includes means to block or restrict removal of the cap from the collar beyond said intermediate position when the cap is under an axial pressure in a direction emerging from the container body.

24. A container as claimed in claim 23 in which said threaded engagement is provided by mutually engageable thread surfaces on the cap and collar respectively and said means is provided by a projection in one thread surface a recess on another thread surface, the projection and recess engaging with each other in said intermediate position.

25. A container body for use in providing a container as claimed in any preceding claim, the container body having a smooth lip extending around the opening thereof and one or more isolated retaining features on an external surface thereof.

26. A cap and a collar for use in providing a container as claimed in any preceding claim.

27. A cap and collar as claimed in claim 26 which are arranged so as to be manufactured as a single component and then separated either before or after the collar has been assembled within the cap.

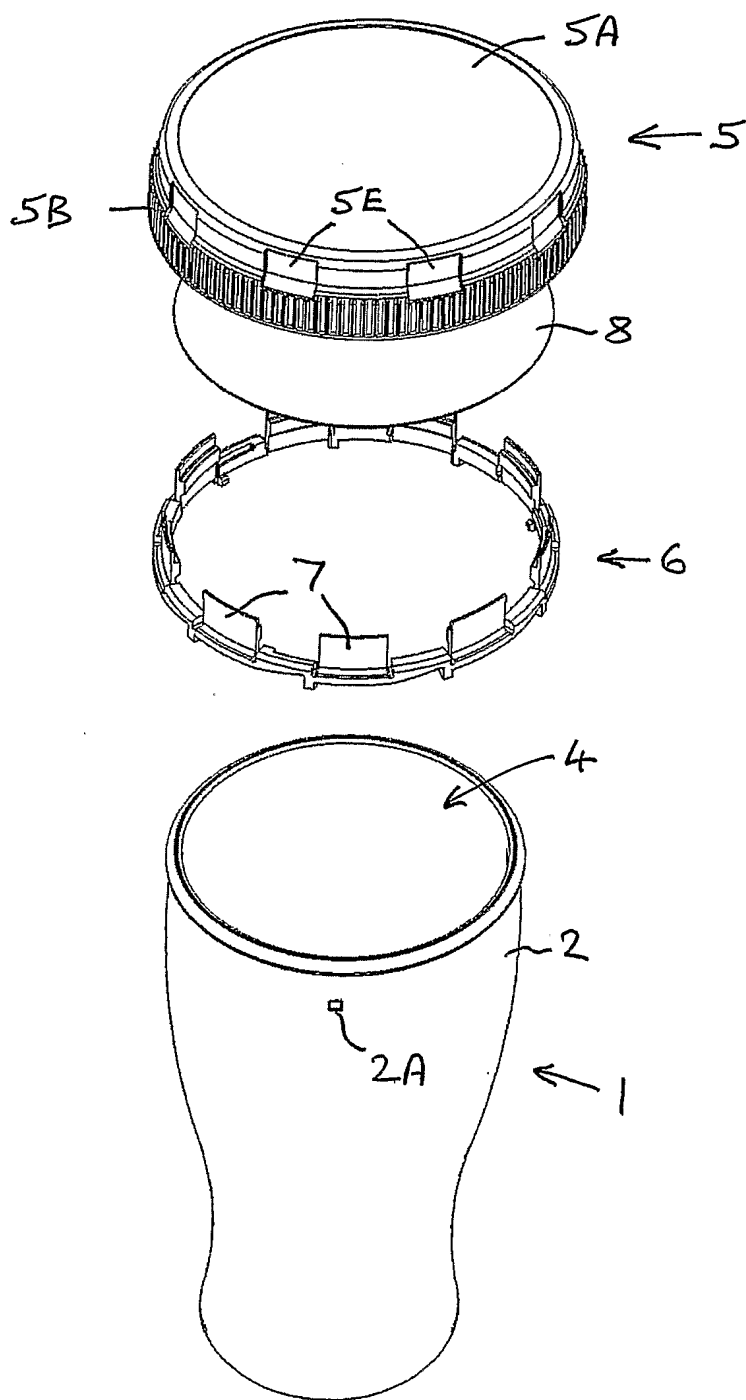


FIG. 1

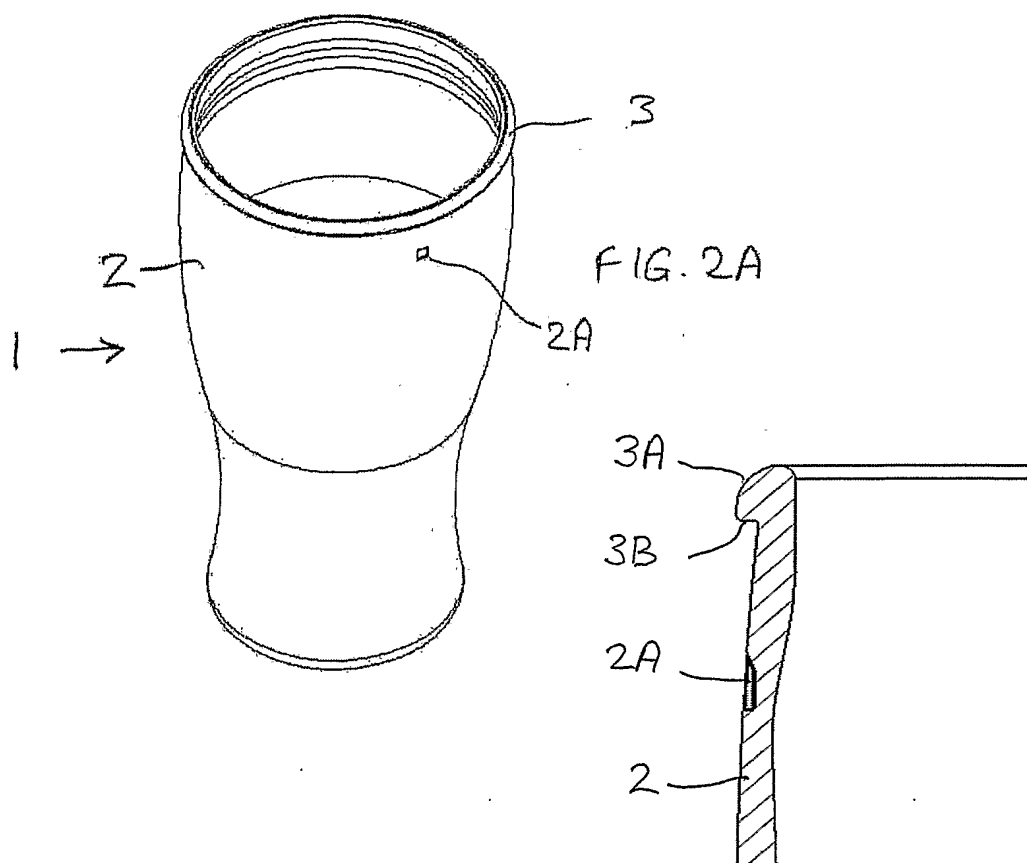


FIG. 3

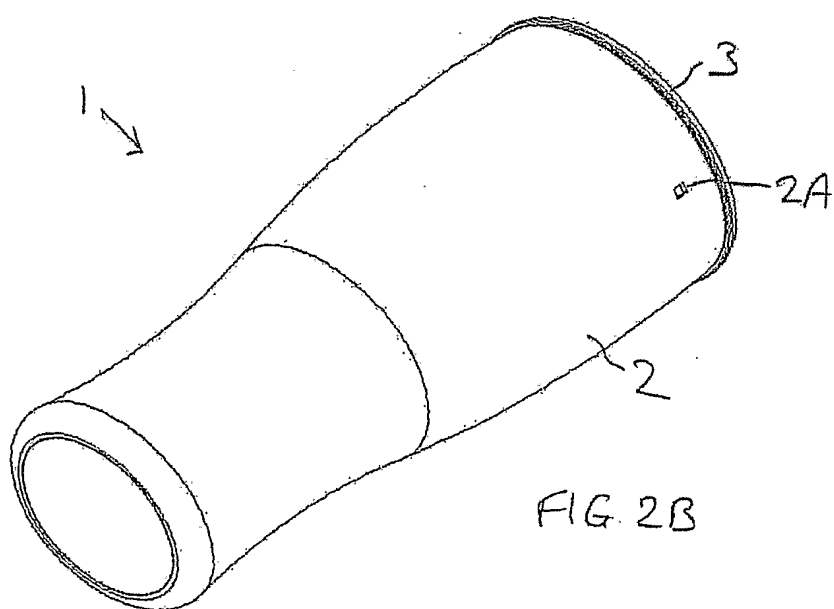
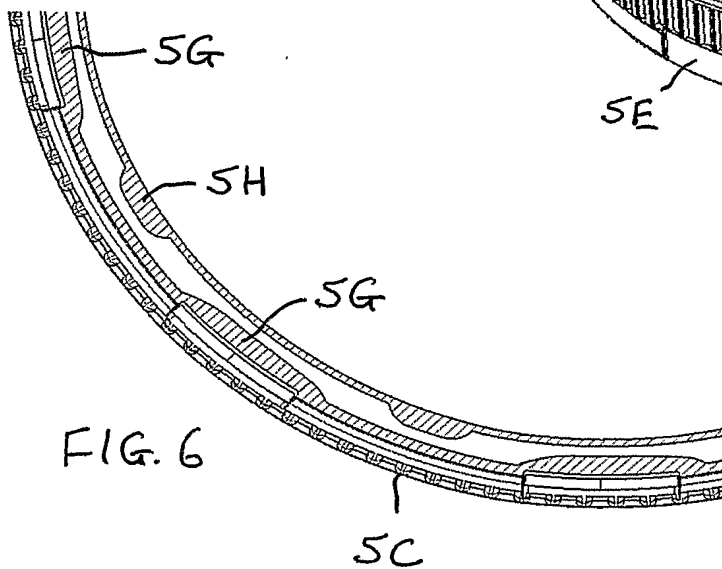
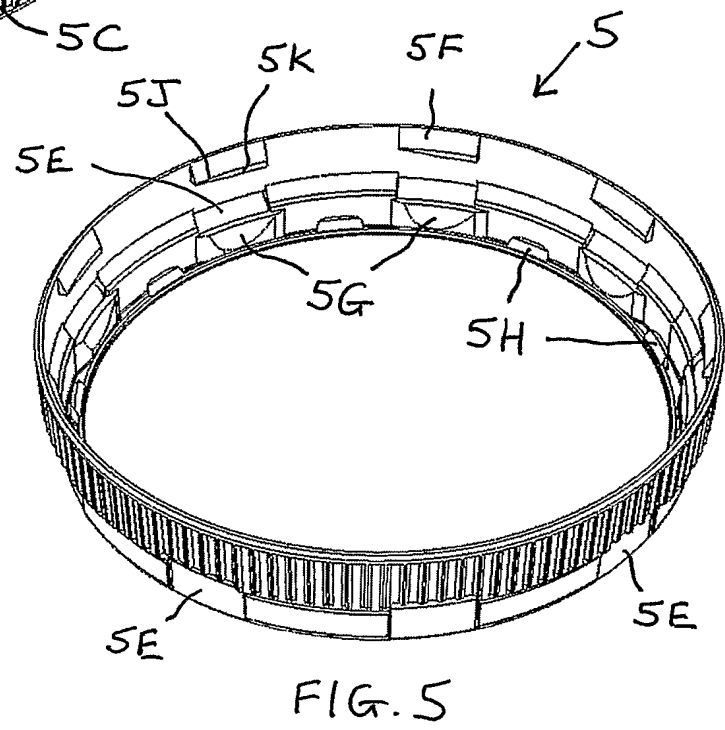
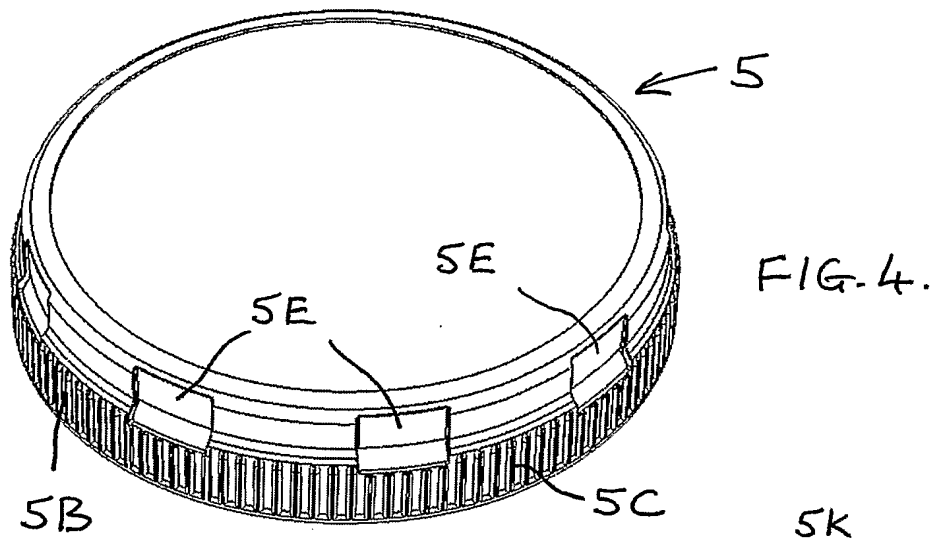
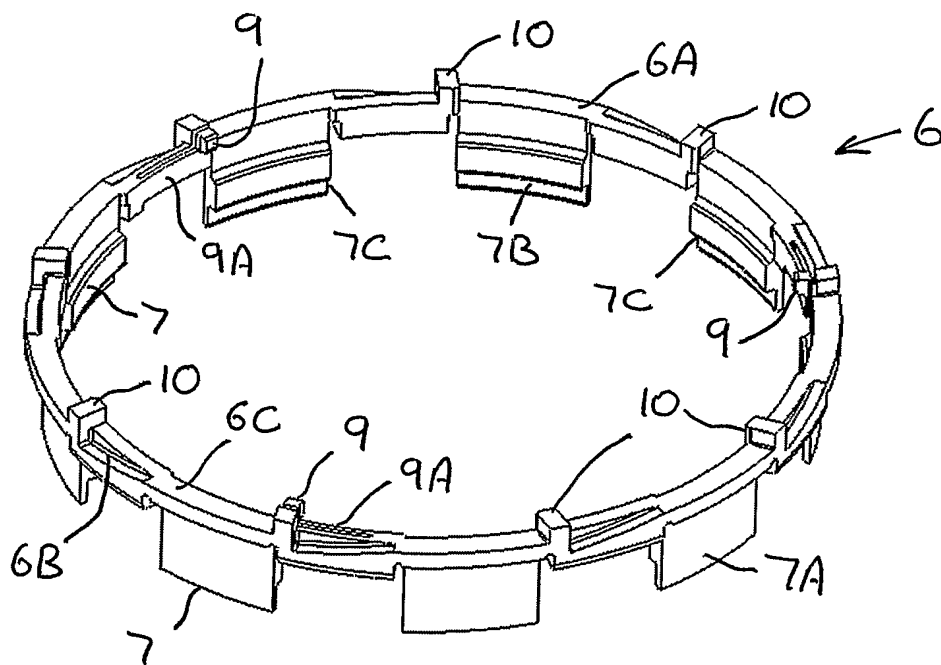
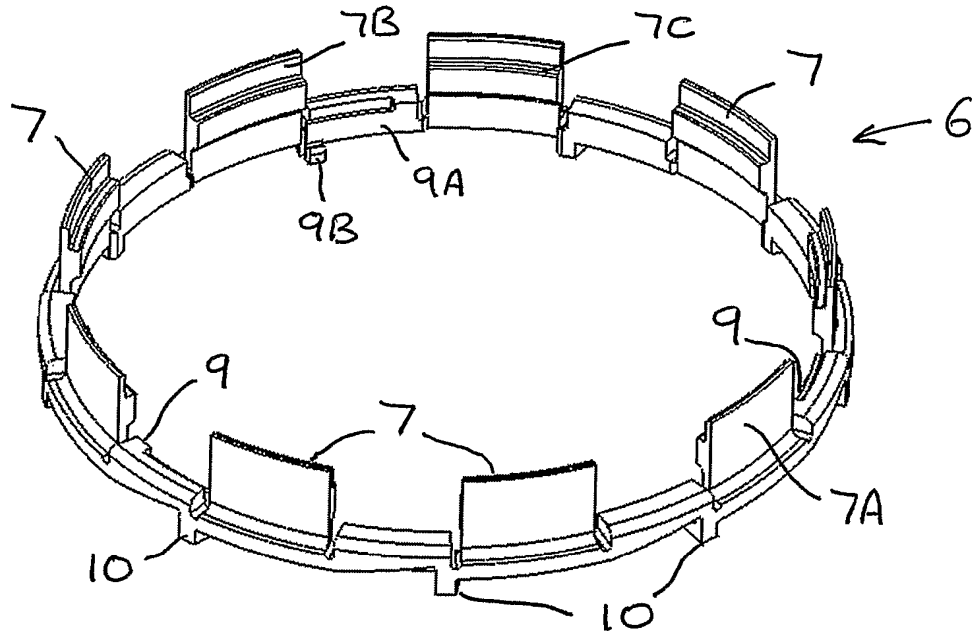


FIG. 2B





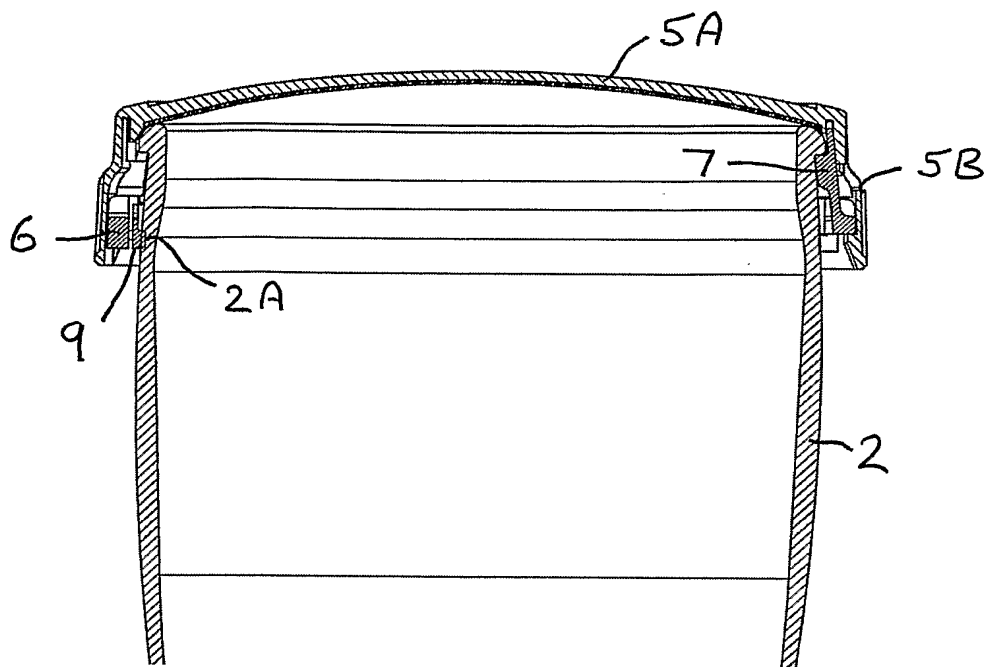


FIG. 9A

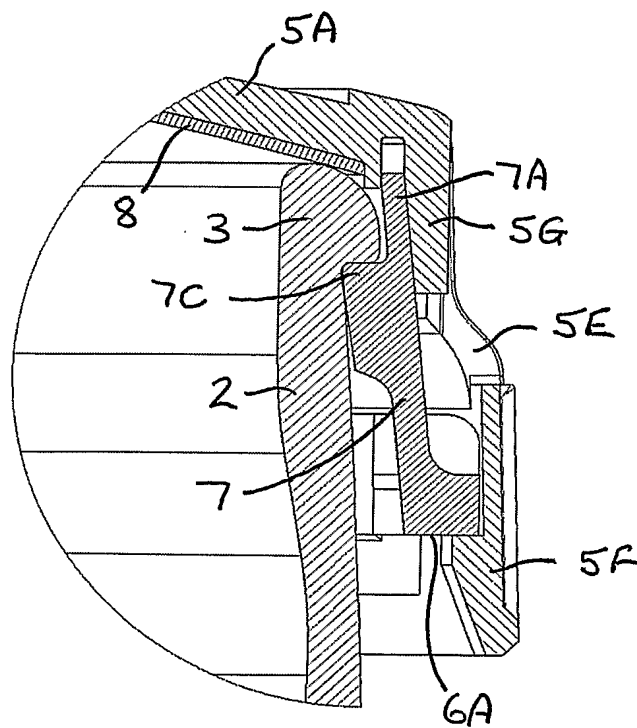


FIG. 9B

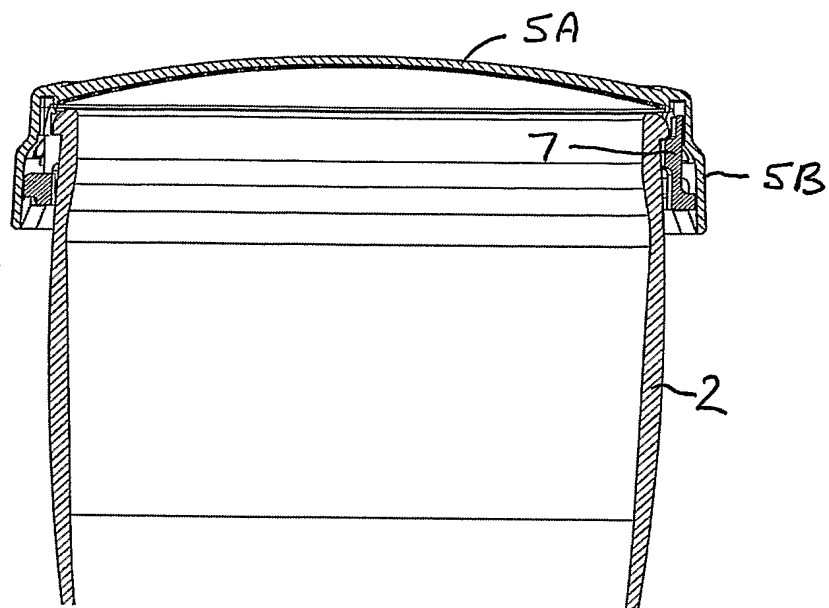


FIG. 10A

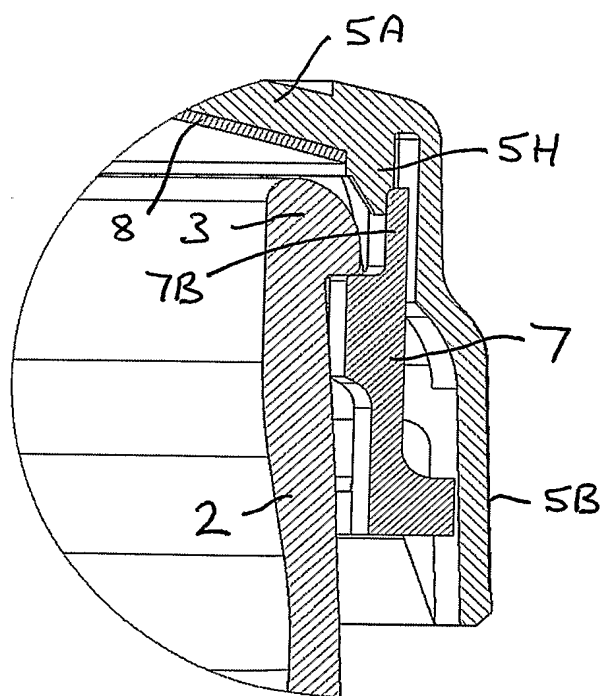
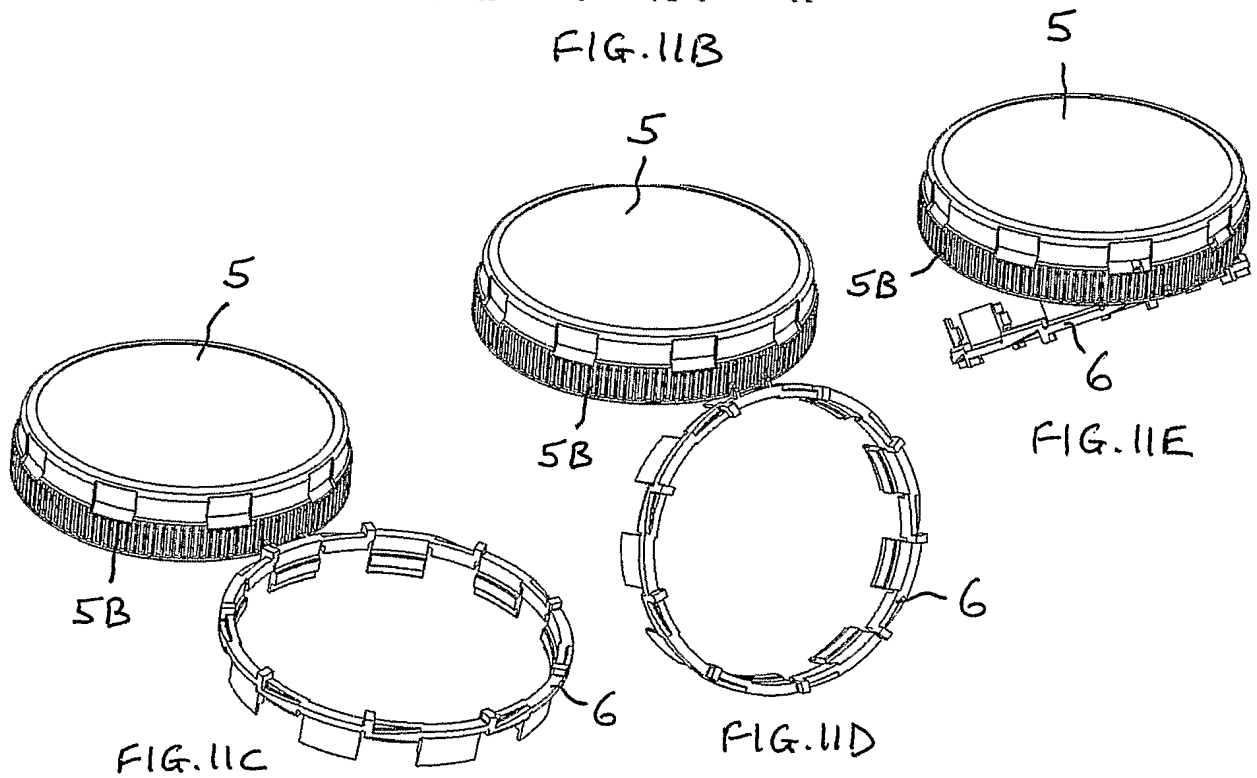
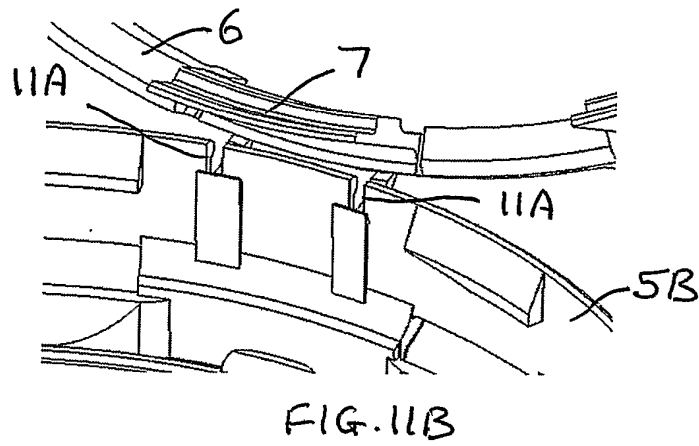
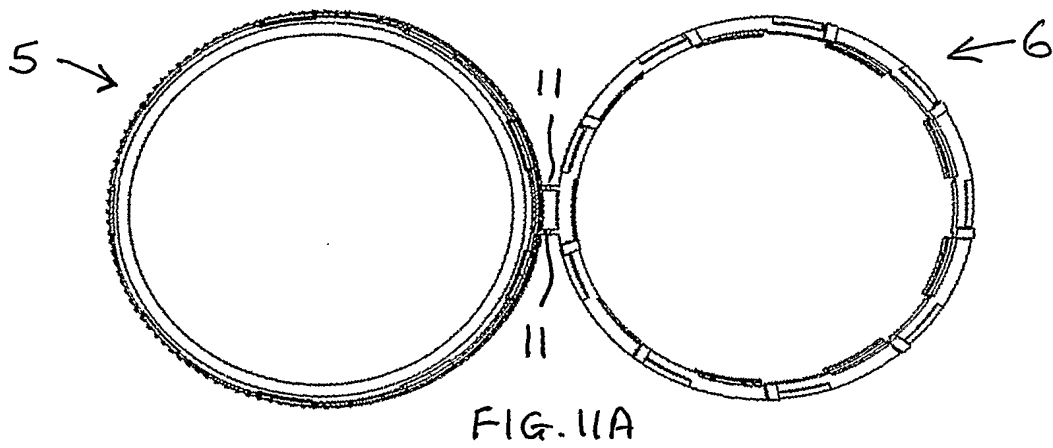
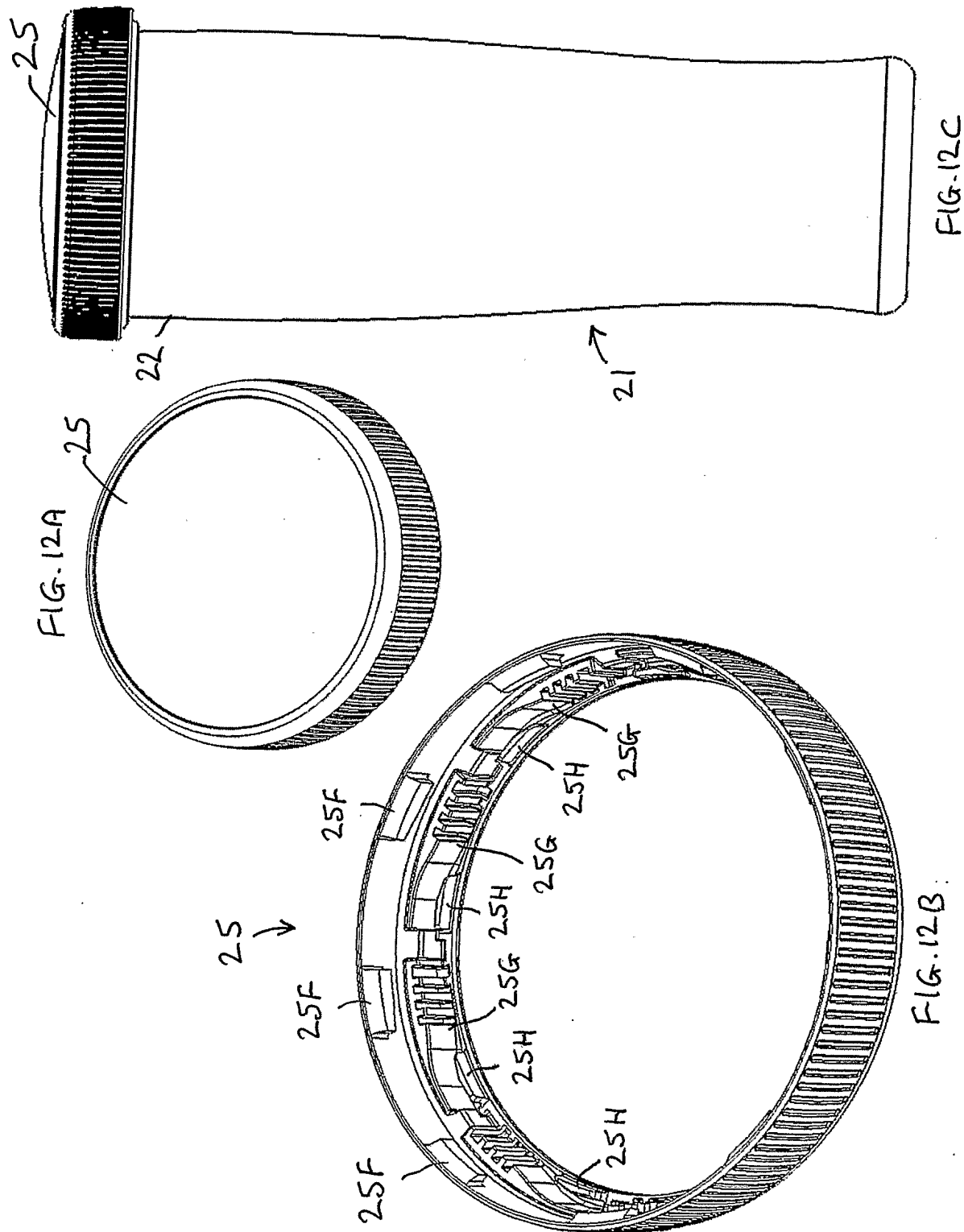
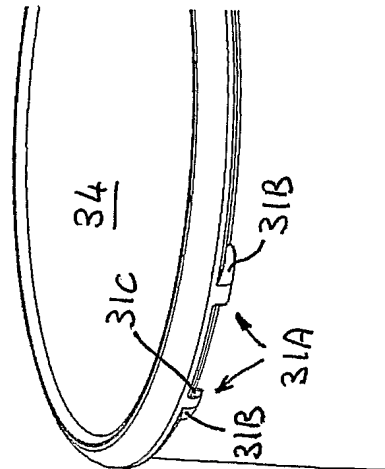
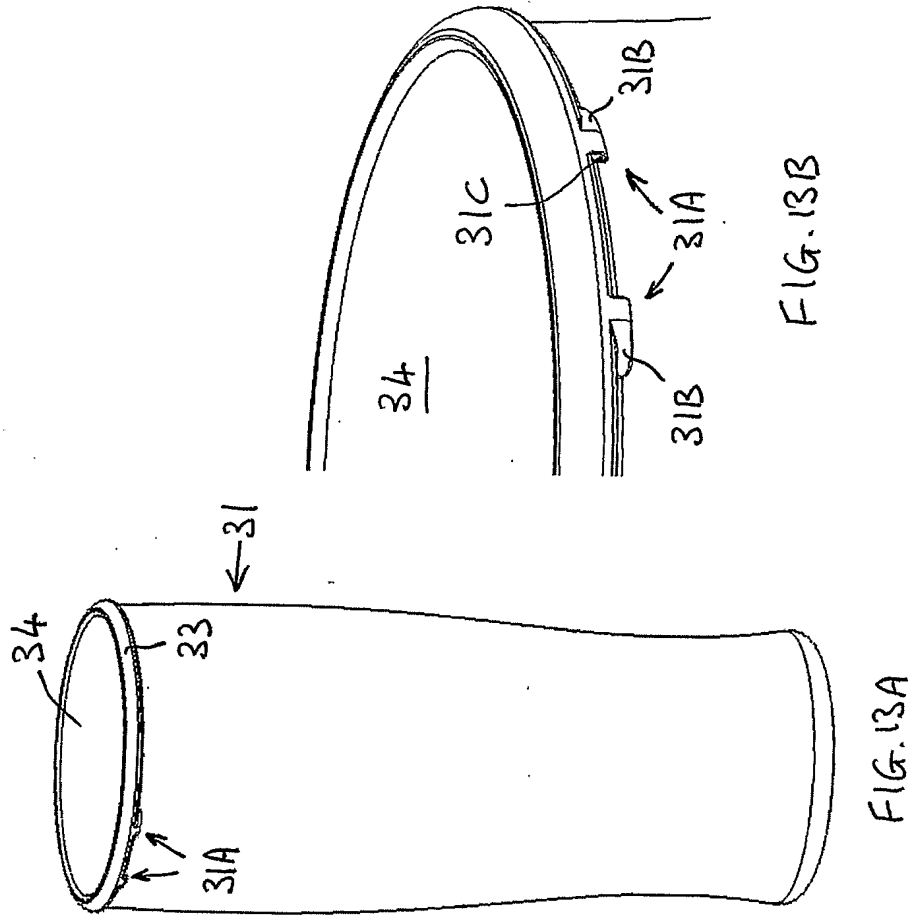
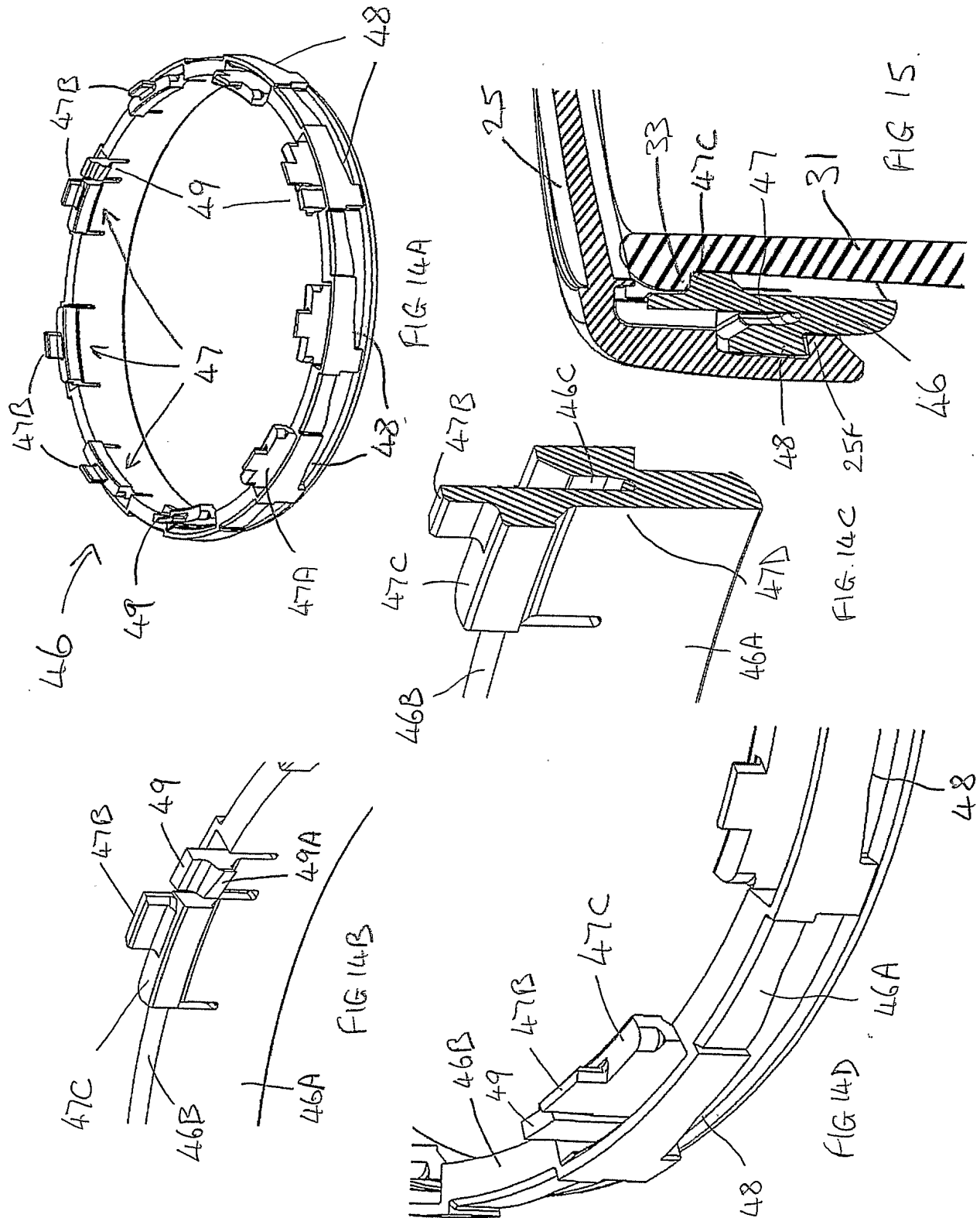


FIG. 10B









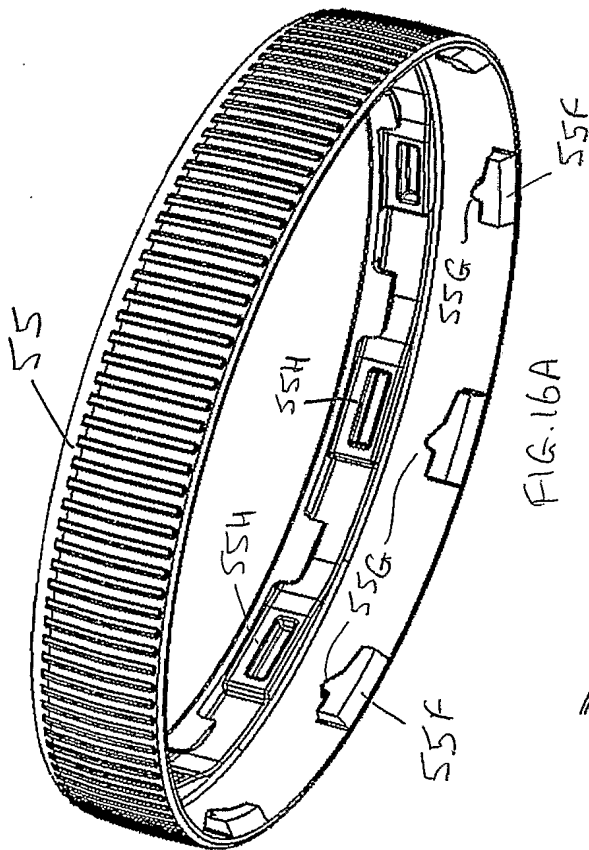


FIG. 16A

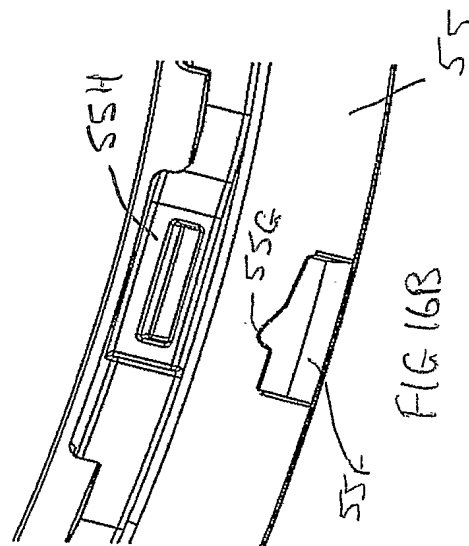


FIG. 16B

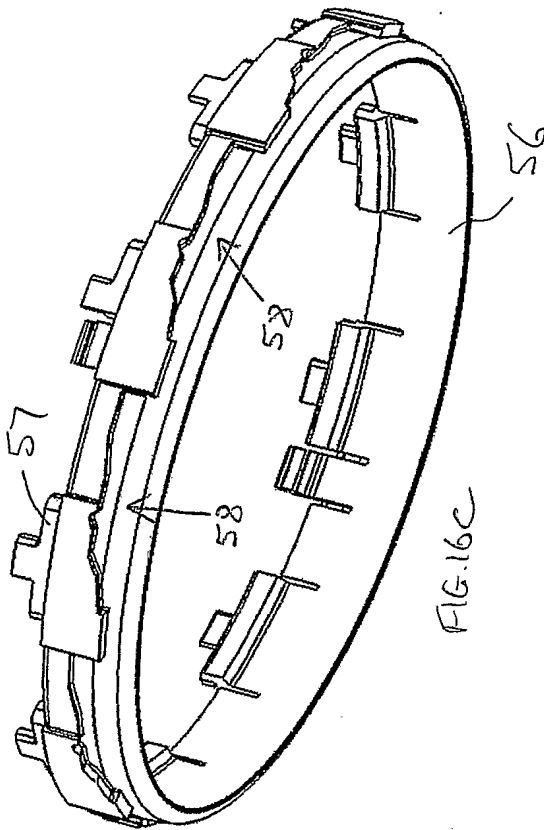


FIG. 16C

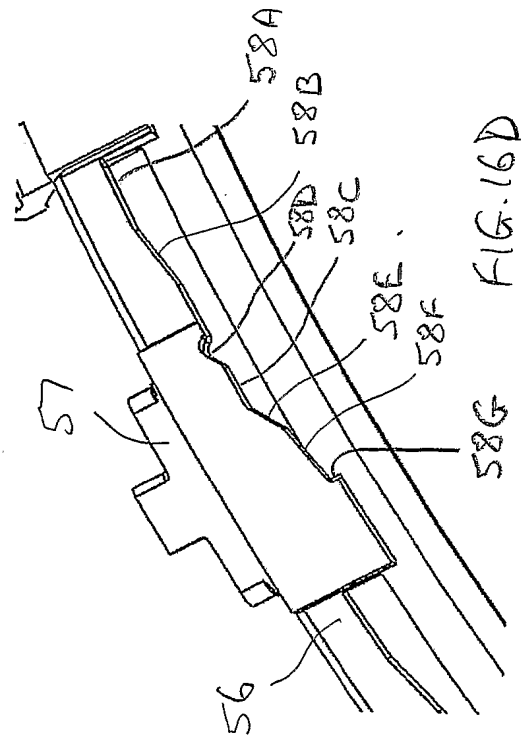


FIG. 16D

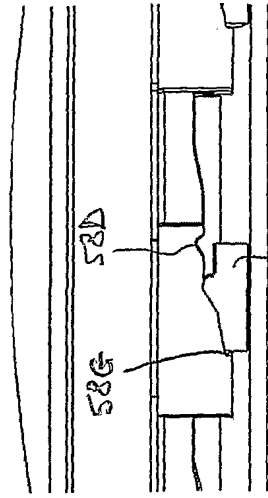


FIG. 17C

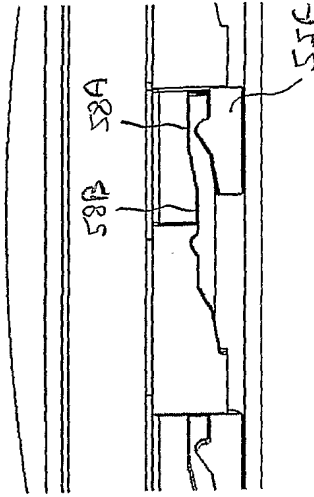


FIG. 17F

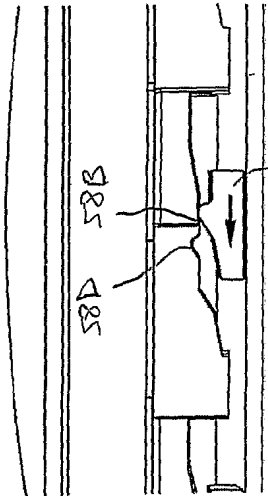


FIG. 17B

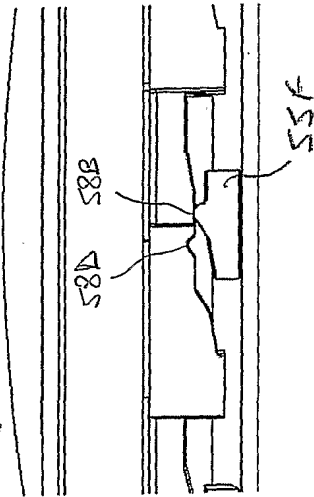


FIG. 17E

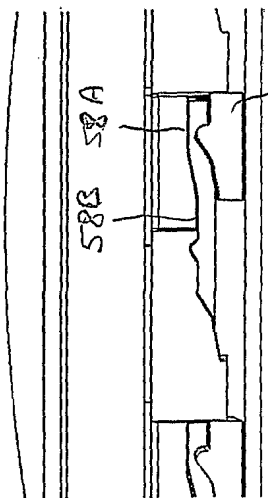


FIG. 17A

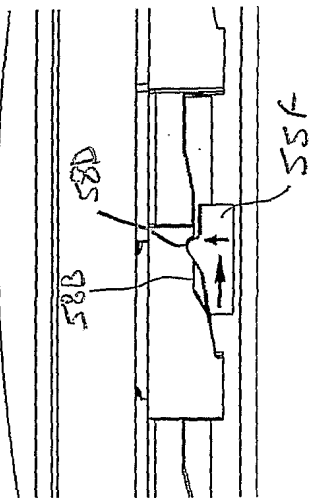


FIG. 17D

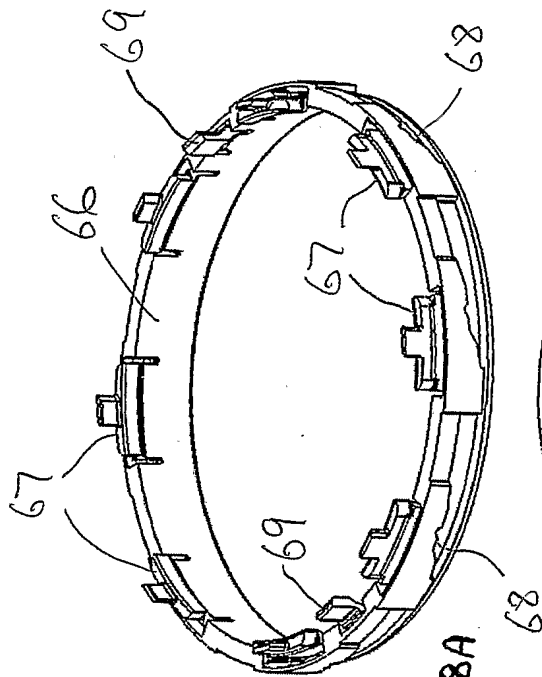


FIG. 18A

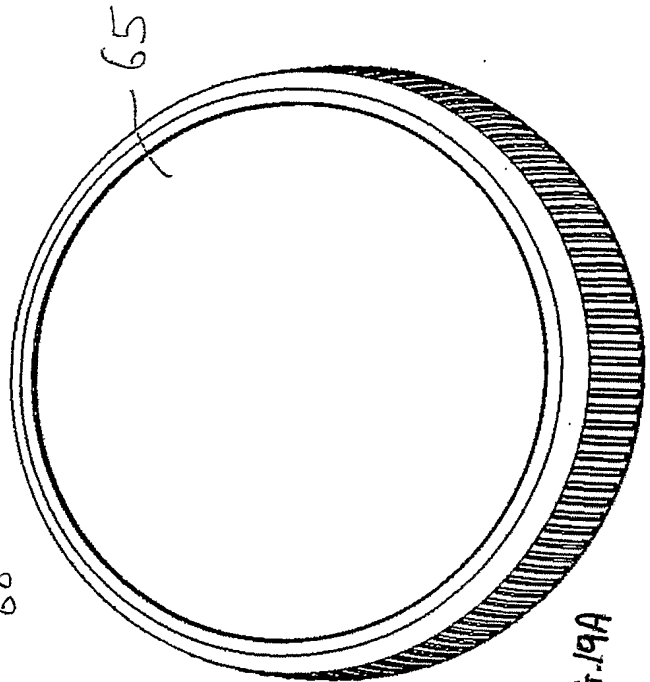


FIG. 19A

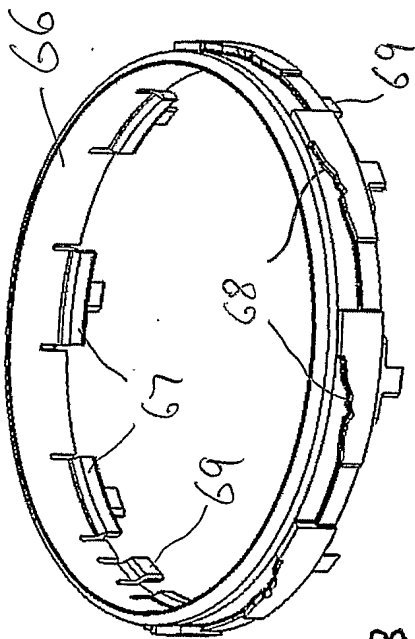


FIG. 18B

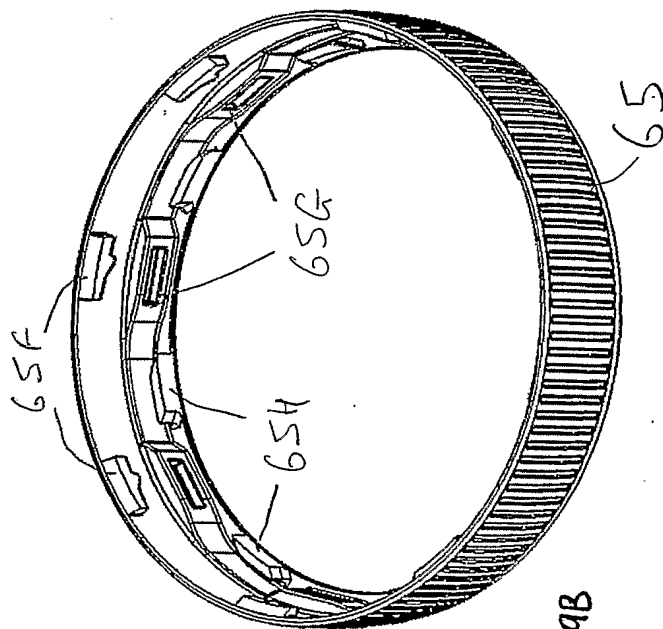
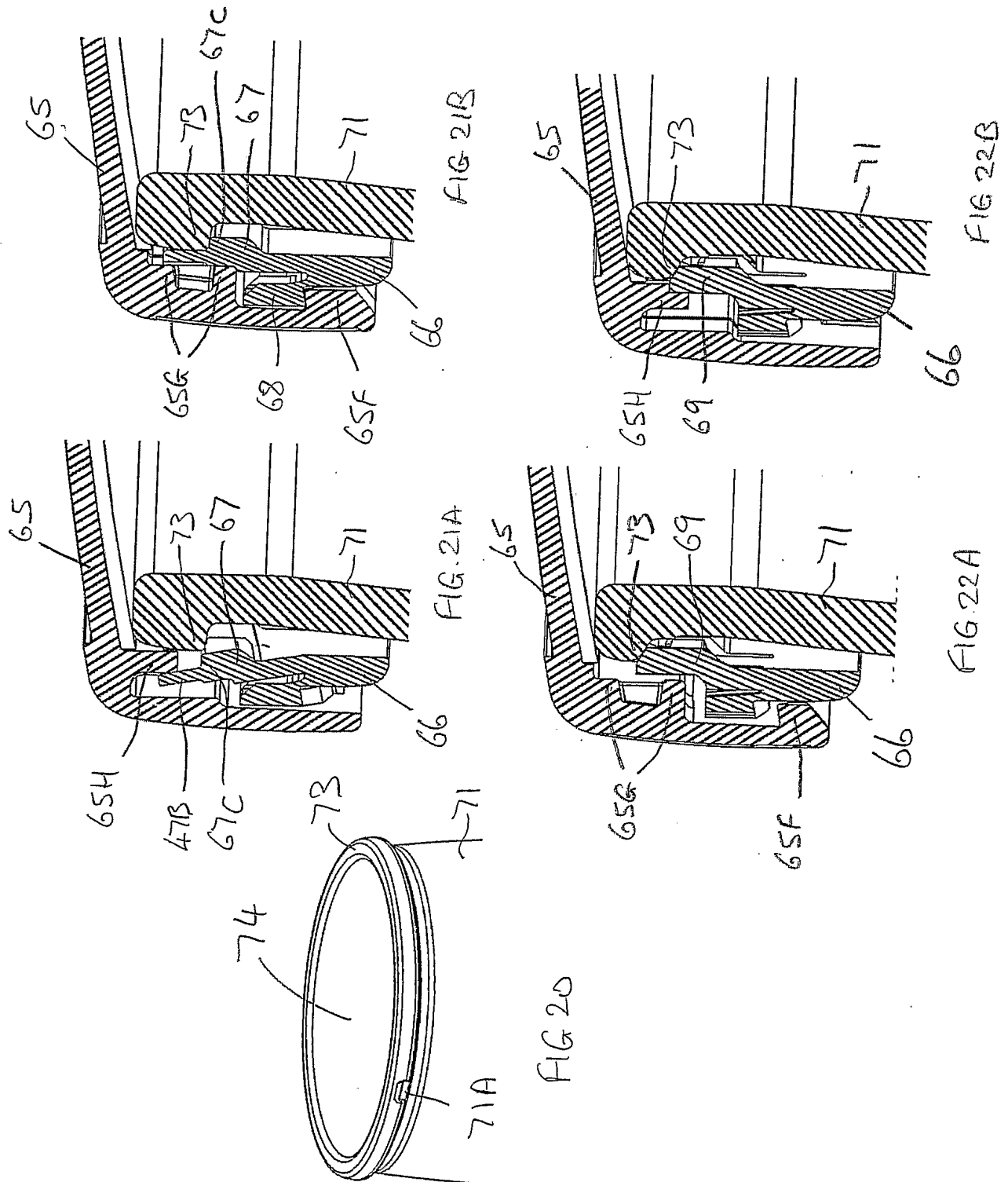


FIG. 19B



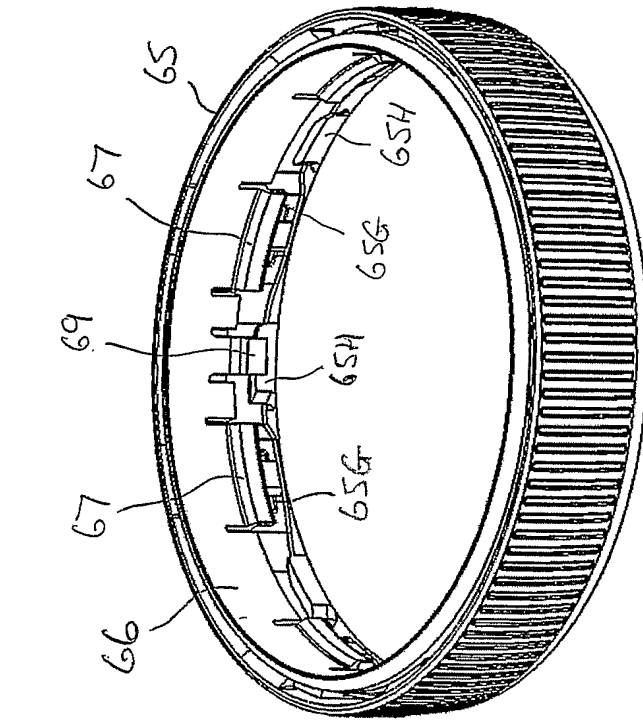


FIG. 23B

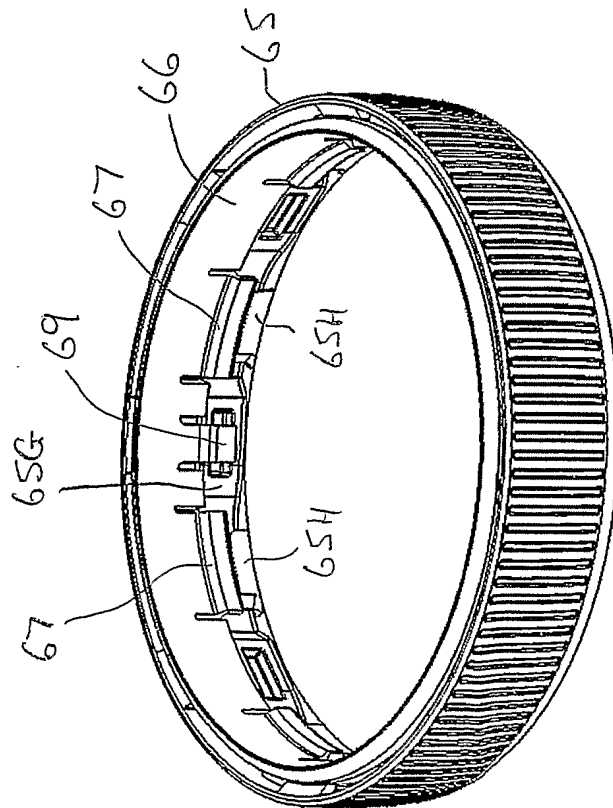


FIG. 23A

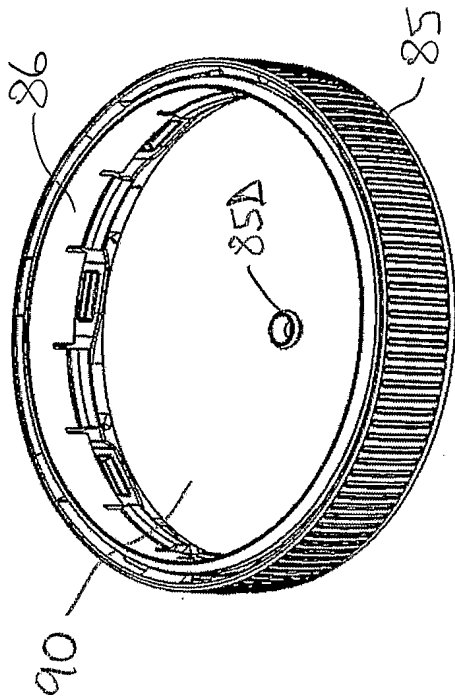


FIG 24A

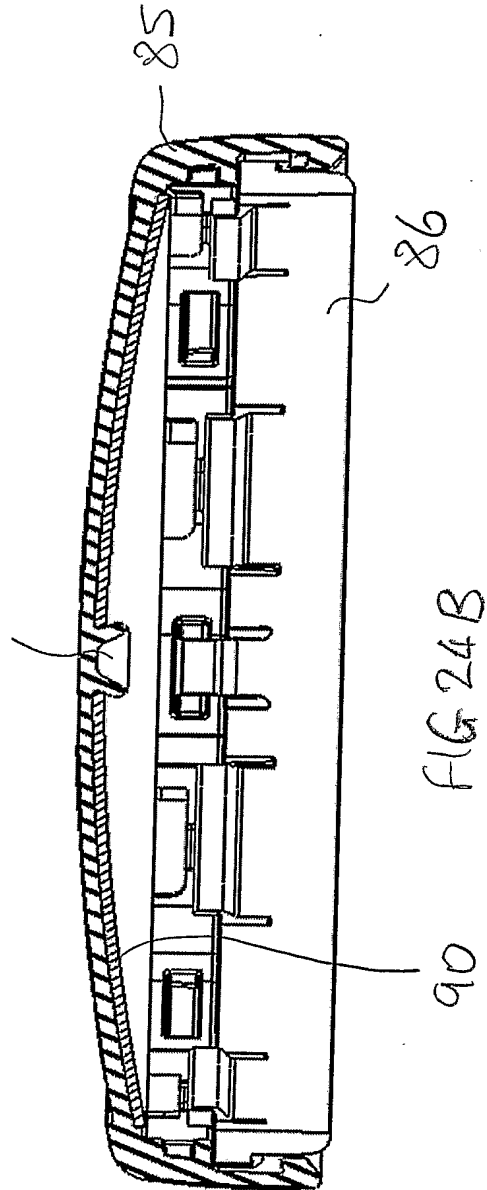


FIG 24B

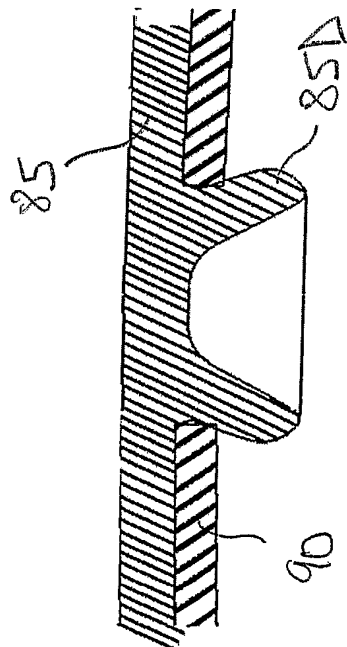


FIG 24C

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(74) Agents: **UNWIN, Stephen, Geoffrey** et al.; Fry Heath & Spence LLP, The Gables, Massetts Road, Horley, Surrey RH6 7DQ (GB).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

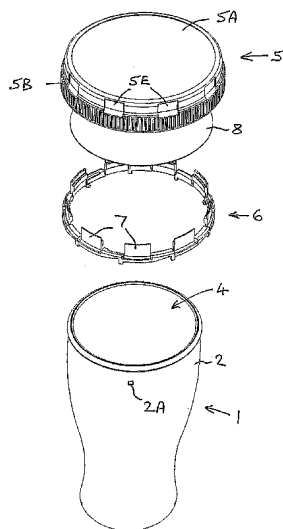
Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:
27 September 2007

[Continued on next page]

(54) Title: CLOSURE ASSEMBLY COMPRISING A CAP AND COLLAR



(57) Abstract: A container comprising a container body (1) having a circular opening (4) which defines an axis, a cap (5) to close the opening (4) and a collar (6), the cap (5) comprising an annular skirt (5B) having a plurality of spaced apart projections (5F) around its inner circumference and the collar (6) comprising a ring with a plurality of spaced part flaps (7), (or other radially moveable parts) provided thereon, the collar (6) being arranged to fit between the container body (1) and cap (5) with their axes aligned such that the projections (5F) engage axially facing surfaces (6A) of the ring and the flaps (7) (or other radially moveable parts) engage an axially facing surface (3B) of a lip (or other features) (3) of the container body (1) whereby the cap (5) can be secured to the container body (1).

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2007/000436

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D41/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2006/000774 A (DUBOIS LTD [GB]; FARRAR PETER ANTONY [GB]; HEIN JOHN [GB]; FRASER ANTH) 5 January 2006 (2006-01-05) cited in the application	1, 2, 6-9, 14-16
A	the whole document	4, 5, 10, 11, 17-21
Y		3
Y,P	EP 1 659 071 A (PATHTAINER SYSTEMS INTERNAT PT [AU]) 24 May 2006 (2006-05-24) the whole document	3
X	US 5 660 290 A (HAYES THOMAS H [US]) 26 August 1997 (1997-08-26)	1, 2
A	the whole document	3-11, 14-21
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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& document member of the same patent family

Date of the actual completion of the international search

23 May 2007

Date of mailing of the international search report

20/07/2007

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Authorized officer

Pernice, Ciro

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2007/000436

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 859 709 A1 (TOURNAIRE SA [FR]) 18 March 2005 (2005-03-18) the whole document	1-11, 14-21
A	GB 735 963 A (ROBERT FELIX LARRIVE) 31 August 1955 (1955-08-31) the whole document	1-11, 14-21

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2007/000436

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-11, 14-21

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-11, 14-21

A container comprising a container body including a circular opening, a cap to close the opening and a collar, the cap comprising an annular skirt portion having a plurality of spaced apart projections around its inner circumference and the collar comprising a ring with a plurality of spaced apart flaps, the collar being arranged to fit between the container body and cap with their axes aligned such that said projections respectively engage axially facing surfaces of the ring and the flaps whereby the cap can be secured to the container body.

2. claims: 12, 13, 22-27

A container comprising a container body including an opening, a cap to close the opening and a collar arranged to fit between the container body and the cap, the cap being rotatable relative to the collar between a first position in which the cap is secured to the container body via the collar and a second position in which the cap is removable from the container body, the cap being secured to the collar by a threaded engagement therebetween, said threaded engagement being arranged to provide a vent for venting gas from the container body, at least when the cap is in an intermediate position (between fully secured and fully released).

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2007/000436

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2006000774	A	05-01-2006	AU 2005256821 A1	05-01-2006
			AU 2005256825 A1	05-01-2006
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